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THE VALE OF KASHMIR.

BY

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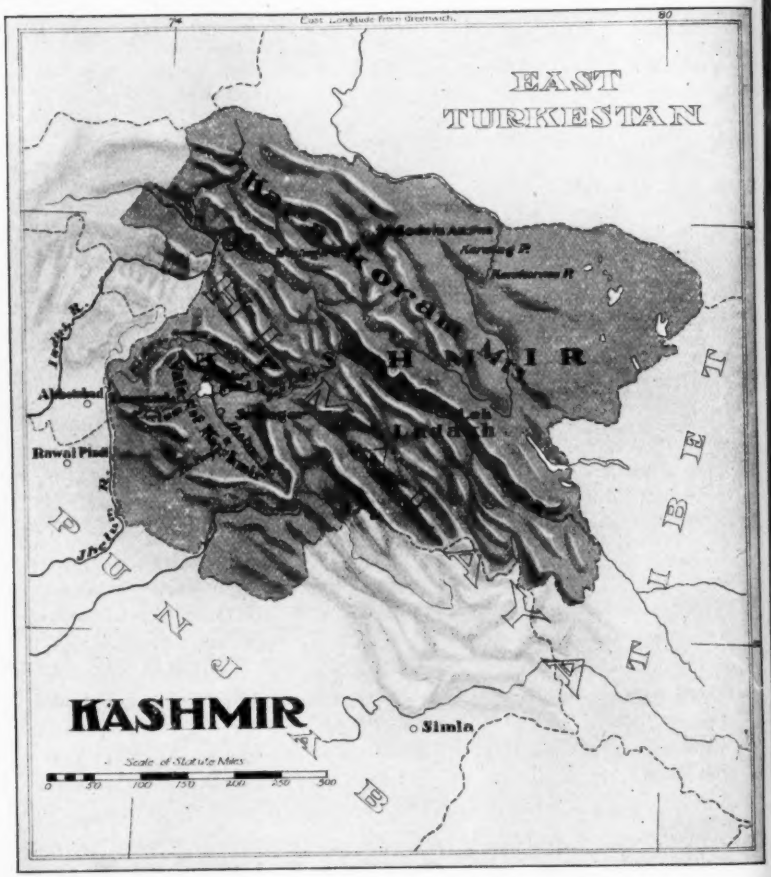
PART I.—THE GEOGRAPHY OF TO-DAY.

The BULLETIN for January, 1905, contained a preliminary notice of the expedition of Mr. Robert L. Barrett *via* India to Chinese Turkestan,—and expedition in which he was accompanied by the author. Our chief objects, as then stated, were the study of "the history of the basins of Central Asia during recent geologic times, and the changes which have taken place since the occupation of the country by man," together with "investigations of the relation of physiography to life, and especially to human life and history." The first subject of serious study was the famous Vale of Kashmir, in the Himalayas, which, with the neighbouring and contrasted region of Ladakh, presents an unusually attractive field to the student of the influence of physical environment upon human habits and character. It also offers some most interesting suggestions as to the possibility that changes of climate during historic times have had a marked effect upon the distribution and habits of man, and hence upon his history and character.

On leaving the warm, low plains of northern India, a six-days' ride (from March 13 to March 18, 1905), in two-story, two-wheeled ekkas, or native carts drawn by one horse, took us north across a low pass about 5,000 feet high in the front range of the Himalayas near Abbottabad and east up part of the gorge of the Jhelum River to the basin of Kashmir. Our first view of the famous valley-plain from a spur a thousand feet above the river was disappointing. Low-lying masses of heavy clouds half hid the lofty encircling ranges of snow-capped mountains; while from the base of the latter flat-topped tongues of piedmont gravel, the tabular remnants of an older, deeper

filling of the basin floor, sloped gently down on either side to a point where they were sharply cut off by low river bluffs. Between the latter a water-logged plain of ploughed or stubble fields expanded to a width of ten or fifteen miles and extended indefinitely to the southeast. A large lake to the north, occasional smaller expanses



of leaden water, and a dark-brown river flowing in a serpentine course from southeast to northwest completed the view. It was interesting but not beautiful, and hence was disappointing. The tops of the magnificent snowy mountains, rising to heights of 15,000 to 18,000 feet on every side of the plain, were wholly concealed

by clouds, and the verdure for which the vale is renowned had not yet appeared. Northeastward from our hilltop the plain soon came to an end where the front range widens and joins the more northeasterly main range; but to the southeast it stretched away ninety miles towards the head waters of the Jhelum, where the two ranges again join, after separating to a distance of nearly fifty miles from one snowy crest to the other.

The Jhelum River, after meandering northwestward through most of the plain, enters the shallow lake of Wular, twelve miles in diameter, at the base of the northern range, and then, on its exit, turning southwest, flows ten miles to the foot of our spur, where it enters the front range at Baramula. At first, in its course through the latter, it runs forty miles westward diagonally across the northern foothills of the front range, and then thirty miles northwestward along the base of the latter in a deep, picturesque mountain valley broad enough to allow a road and a few villages at its base. At the mouth of the Kishen-Ganga River, however, which comes down southwestward from the lofty main range, the Jhelum suddenly turns south, and for fifty miles flows transversely across the front range in a gorge so deep and narrow that the famous Murree road is obliged to leave it and climb 5,000 feet over a pass in order to reach Rawal Pindi, a few miles west of the point where the river emerges on the main southern plain. The Jhelum, like the Indus, seems to be an example of a river which has preserved its course unchanged since some far past time when the country was much flatter than at present. Now, however, it has sawed its way deep into the heart of a strip of country fifty miles wide and hundreds long which has been warped up along its course, forming the front range of the Himalayas between the elevated basin plain of Kashmir to the northeast and the low plain of the Punjab to the southwest.

As we descended from our hilltop and reached the brown grassy slope half a mile from Baramula, five or six men, armed with portfolios, converged threateningly upon us. One, suggesting a policeman, brandished an official-looking document; a second waved a photograph; a third held a drawing like the plan of a steamer; and the others carried open letters. They all thrust their papers into our unwilling hands, and, in the broken English now spoken by many natives of Kashmir, shouted in rivalry, "Master! master! read this!" "This my boat; very best boat. Twenty rupee." I got best boat. I am six men." "Come, master, see my boat!" In spite of protests, they escorted us to the village, helped us through the mud six inches deep, led us between the two-story wooden houses with

their pyramidal thatched roofs green with grass, and brought us to the collection of houseboats on the muddy river. We thought of the jolting of our carts, and of what would await us when we left them at Srinagar, the capital, either a poor and expensive hotel or its alternative, a wet camp with no proper servants, and speedily yielded ignominiously to our captors. We engaged Subhana Benares, who claimed to be six men, together with his father, four brothers, a sister, two wives of some of the family, a modest houseboat with four small rooms roofed with reed-matting, a smaller kitchen-boat where the natives were to live and cook, and a row-boat, for all of which, including people and boats, we were to pay thirty-five rupees (eleven dollars and twenty cents) per month. Other expenses were correspondingly low, even though Subhana considered it necessary for his two "Sahibs" to have five or six pounds of "soup-meat" per day and other articles in corresponding amounts. We noticed that there was much to "throw away," and that our retainers seemed to be very well fed. Nevertheless, our seventeen days in a houseboat proved economical, though also, I regret to say, rather cold and uncomfortable, because of the time of year.

The first view of Kashmir from the Baramula spur and the experience with the houseboat impressed upon us many of the most salient features of the country. First among these is its isolation from the rest of the world by a ring of lofty mountains, unbroken except by the narrow gorge of the Jhelum; next, its great elevation of 5,000 feet and consequent comparatively cool climate, warm and damp from June to August, though but little rain falls, mild and delightful in April, May, September and October, and cold and snowy in winter, so as to be not only bracing but at times rigorous. The nature of the climate gives rise to another characteristic feature—namely, a superabundant water supply, derived partly from a precipitation of about twenty-five inches, mostly snow, on the plain, and much more from the heavier snow-fall and summer rains of the surrounding mountains. The smooth plain of fine rich soil, easily cultivated and easily flooded, presents another salient feature—one which owes its origin to the character of Kashmir as a basin deeply floored with fluvial deposits. A fifth feature is the beautiful scenery of the snow-capped mountains and green lower regions, which, combined with the temperate climate, makes Kashmir the most attractive of summer resorts for the people of India, chiefly the English; lastly, numerous terraces and deposits of gravel indicate that the region has been subject to varying climatic conditions in the not far distant past. Each of these fea-

tures meets with its appropriate ontographic response in the habits and character of the people. Some of the more interesting responses will be considered in this article; but a much larger number must be left untouched, for the study of geography as the science of the relation between earth and life is as yet so undeveloped that many, perhaps most, of the responses of living creatures to their environment have not yet been correlated with the physical features to which they owe their origin.

Kashmir presents one of the best opportunities for the study of the relation of man to his surroundings, for from the earliest-known times the basin has been occupied by a single race. The people are Aryans allied to those of northern India in blood and language, but far less subject to outside influences because of the high mountain barrier, which has not only made invasion a rare occurrence but has restricted external trade and migration. Hence they have been largely left to work out their own destiny in response to whatever racial characteristics they originally brought with them, modified by the influence of religion and other introduced ideas on the one hand, and of physical environment on the other. Three religions have prevailed successively—Buddhism, Brahmanism, and Mohammedanism—each of which has doubtless had its effect. Nevertheless, according to Stein, the chief authority on the history of Kashmir, the character of the mass of the people seems to have changed but little since the Buddhist days thirteen centuries ago, when the keen Chinese pilgrim Hiuen Tsiang described the Kashmiris as "light and frivolous, and of a week, pusillanimous disposition; handsome in appearance, but given to cunning; fond of learning, and well instructed."

In response to the height and difficulty of the passes across the mountain border of his plain, the Kashmiri has not only been comparatively little troubled by the visits of either enemies or friends, but has rarely gone away from home, either for war, trade, or settlement. The result, as several writers have pointed out, is that he is cowardly, exclusive, and suspicious. Till lately he has hated and feared the few foreigners whom he has seen, and has suspected them of designing evil against himself; and, naturally, has tried to keep them out. The cowardice of the Kashmiri outside Kashmir is proverbial, and at home it is laughable. Several times in the street when I met men and unexpectedly turned on them or asked them questions, no matter how mildly, they started and trembled as though threatened with a pistol; and this is said to be a common occurrence. Mr. C. E. Biscoe, head of the large schools of the Church Missionary Society, which

even the natives generally recognize as the best in Kashmir both as to education and as to character-building, told me that when compulsory exercise was first introduced, the boys, chiefly Brahmins, with a lesser number of Mohammedans, were abjectly afraid of the water, though they had lived beside it all their lives. In order to make them learn to swim it was necessary simply to throw them into the canals. Now, however, they have learned to do fine work both in and on the water, and during the last great flood, which half submerged Srinagar, saved much property and some lives. To be sure, they are still cowardly; but there has begun to be a school spirit which makes them ashamed to show their fears. Similarly, in football the boys at first ran away from one another; but now many of them stand up pluckily and run the risk of getting hurt, which shows that though isolation may have made the Kashmiris cowardly, they have a certain amount of moral fibre capable of cultivation.

Exclusiveness was carried so far in Kashmir in the Middle Ages that practically all foreigners were kept out, just as has more recently been the case in Tibet, perhaps for similar physical reasons. Even today, in spite of the incorporation of Kashmir in the British Empire, the old ideas prevail so far that no foreigner can remain in the Vale without a permit—renewed, I believe, annually; nor can a foreigner buy or build a house or own land. Natives, or the native Government, build to order. That is one reason why houseboats are so common; for in a boat not only does the landlord become one's servant, but one can move about freely. To people who are on the outside and want to get in, the seclusion of Kashmir seems a bad quality; but it has at least one advantage. Drew* relates how, on the Pir Panjal pass, to the south of Kashmir, at an elevation of 11,400 feet, he "found the ground and the snow for two or three miles' distance strewn with dead locusts [a pest on the plains to the south], which about the middle of May had been destroyed by the cold in an attempted invasion of Kashmir."

The climate of Kashmir is comparable in some respects to that of the northeastern part of the United States, although the sun is hotter, because of the more southerly latitude; the summers are more trying, because the heat is more rarely interrupted by showers and cool storms; and snow falls earlier in the autumn, because of the great altitude, so that the crops are sometimes ruined by it. The first day of our stay in Kashmir (March 19) was warm and clear. Our boat was being towed slowly eastward up the river by the boys and girls of our native family, who trudged barefoot along the towpath

* Jummoo and Kashmir, p. 158.

at the rate of less than two miles an hour. A stroll on shore in the bright sun among thatched houses surrounded by orchards or beside broad pools, with glimpses of hunters shooting waterfowl with huge blunderbusses, and a clear view of the wonderful ellipse of snowy mountains encircling the plain, made us realize that Kashmir can be idyllic. Most of our twenty-two days in the basin, however, were cold and raw, with several frosts and a little snow, so that we sympathised with the natives who went about with "gungris" under their long, dirty, white cotton gowns. The "gungri" resembles a large flower-pot made inside a wicker basket, with a protective wicker handle, like the arches of a half dome. When filled with live coals it serves to warm the hands—or, oftener, the whole body—by being put under the loose outer robe of either man or woman and held over the stomach whether the people are walking or sitting. It is essentially a lazy man's device; for no one can hold it and work, and it reflects the habits of the Kashmiri, especially of the farmer, who in the snow and mud of winter has nothing to do.

The abundance of the water supply of Kashmir and the smoothness and softness of the fine-soiled plain have led to the formation of an intricate network of deep, slow-moving waterways, partly natural and partly artificial, difficult to ford but easy to navigate, and often overflowing. Hence, as Stein points out, the roads are very bad; and as outside traffic is largely shut out by the mountains, beasts of burden are rare, wheeled vehicles are practically confined to the single new thoroughfare down the Jhelum, and traffic is carried on in boats, the loads being usually carried for short distances on men's backs. Almost every village is said to have its landing-place, either close at hand or a mile or two away; and in Srinagar the crowded river and the larger canals are the main thoroughfares.

Another effect of the abundant water and fine-soiled plain, together with the hot summer sun, is great fertility, causing food to be plentiful and cheap. Rice is naturally the chief crop; and though other grains grow well, they are of secondary importance. The water-chestnut, shaped like a pair of stocky cows' horns and dredged from the bottoms of the streams; many kinds of greens and vegetables, of which great quantities are eaten; and fruit, especially apples and pears, are other profitable crops. Cheap food may be a blessing, but in Kashmir one is inclined to doubt it. It seems as though the ease with which a living can be made were the chief cause of the reputed idleness and laziness of the people; and laziness, aided, perhaps, by the opportunities for dishonesty afforded by the large amount of local traffic and barter which the abundant waterways foster, may be re-

sponsible for much of the untrustworthiness which is said to be so prominent a trait of the Kashmiris. In this respect the latter are like the people of many parts of India; though they are not so lazy, perhaps, by reason of the invigorating winter climate of their mountain home.

Our own life during the two weeks which we spent in Srinagar in our house-boat was a direct response to the abundance of water, the smooth plain, the fertility of the soil, and the consequent cheapness of the necessaries of life. Like most travellers to Kashmir, we lived in a leisurely fashion. The snow on the passes delayed our start across the mountains, and the slowness of the people prevented haste of any sort. We enjoyed the quaint wood or brick houses, with their green grassy roofs, the orientalism of the narrow, dirty streets, and the busy life of the pleasanter canals. We went sight-seeing in our own "shakari," or flat-bottomed boat, with three or four oarsmen. Brahmins squatted naked on frosty mornings while they bathed at the foot of steps leading to little temples with high, top-heavy silvered domes; market women passed down the canal with boat-loads of spinach and turnips from the floating gardens in the Dal Lake, mere rafts of water-plants strewn with a little earth; merry children in twos or threes sang musically at the tops of their voices; and men clothed in dirty white walked briskly along the embankments beside the canals under the fine bur-covered chenar trees just as old Hiuen Tsiang reports them to have done long ago. Except for the fast walking—fast compared to that of India—the general appearance was leisurely. The Kashmiris, as has been said, have a reputation for laziness; but when I watched them working they seemed to show a good deal of energy and steadiness, though perhaps it was only to keep warm. Along the canal where we anchored, at least a dozen houseboats were being built for the accommodation of summer visitors, and all the timber was sawed into planks on the spot by hand. The men who worked the big saws, one at either end, kept at work steadily, though the labour is tiresome, and twice during ten minutes I noticed that when one of a pair had to stop for something his comrade went and helped some one else.

Within the last few decades a new factor has entered into the geographic development of Kashmir—namely, the attraction exercised by its climate and scenery upon the British sojourners in India. The æsthetic element of love of scenery and the rational element of choosing a place for a home for the sake of its favourable climate, though strictly geographic factors, exist only in highly-civilized communities. Therefore, in the past they have been of small import-

ance; but as their significance is more and more appreciated, it is probable that they will exert a growing and even a preponderating influence upon the distribution of intelligent people in countries not blessed in general with the invigorating climate of the cool Temperate Zone. To-day, for instance, India is governed from the small hill-station of Simla rather than from hot Calcutta; and retired Indian officers and civil servants who cannot return to England are beginning to see in Kashmir a place where it is possible to settle permanently in spite of the restrictions imposed by the native Government. Already the great influx of summer visitors has caused a considerable number of Kashmiris to become servants or keepers of houseboats; a distinct impetus—not always beneficial, because it encourages the use of cheaper, less durable, dyes—has been given to the highly-developed native arts of rug-weaving, shawl-making, and embroidery; and the merchant class, though always noted for their habit of fastening on a victim, have become more rapacious than ever. Indeed, the merchants are the bane of the foreigner's life in Srinagar. They come in boats and on foot; in the guise of beggars and of princes; before sunrise, at noon, and at night; they dog one if he goes for a stroll; they sit on the bank and wait for hours to pounce upon the chance visitor. When we first tied up to the bank of the canal in Srinagar, Subhana (our factotum) suggestively laid by the door a little willow cane which might have served as a whip, and, in answer to our inquiries, remarked laconically, "For merchant." He evidently appreciated two national traits—the choleric temperament of the British officer from India and the impudent persistence of the otherwise timorous Kashmiri merchant. A typical specimen of the latter stood on the muddy shore one day as I sat on deck in the rare sunshine, and, holding up a gaudy red felt, began:

"See, master, here numda [felt] very cheap. Master buy him cheap." No reply from the traveller.

"Only look, master. No buy; only look." A pause. "You wanting other kind felt? I bringing him, very best." Still no reply.

"I good man, master, honest man. Read my letter," (holding out a well-thumbed bunch wheedled out of every foreigner whom he had ever cheated). "Only read, master. I not like other man. I good man."

"No, put them up; I don't want your felts," I answered at last.

"I got boots, master," trying a new tack. "I am leather man. I new man. I no been here before, master." He had been there an hour a day for three days, had tried to intercept us as we went to make a call, and had shouted to us from the bank as we rowed down the main canal.

Long interval broken only by such remarks as "Very good," "Cheap," "Only look," "Oh, master, look!"

At last a new effort, "What time you say I coming to-morrow morning? Eight o'clock? Very well. I bringing many shoe."

Half an hour of this sort of thing made me regret that the cane had been put away.

The problem of transportation furnishes another illustration of the influence which the invasion of Europeans in summer is having upon Kashmir. On leaving Srinagar on our way to Ladakh or Little Tibet, two hundred miles eastward across the main range of the Himalayas, we first spent a delightful spring day in floating slowly ten miles westward down the Jhelum and in being towed still more slowly seven miles northward up the tributary Sind to the head of navigation at Gunderbal. There we dismissed the houseboat; and then for two short stages shaggy little ponies, secured as a right from the villagers by means of a pass from the British Resident at Srinagar, carried us eastward up through the lovely scenery of the Sind Valley—among spreading walnut trees (often used as hay stacks), among mossy rocks, dashing brooks, and straw-thatched houses. On April 6, at an elevation of about 7,000 feet, we encountered snow too deep for horses, and were obliged for nine days to walk and have the load carried by coolies. When the first detachment of men was being procured at Gund a great uproar in the muddy courtyard called us out from our smoky, windowless room to the second-story balcony among the cows which ambitiously mount the broad stone steps. In their usual fashion, the Chief Men of the village were delaying matters because snow was falling and the road might be bad. Our headman, a remarkably trustworthy and energetic Mohammedan from Ladakh or Little Tibet, had knocked down one village official into the mud and had beaten another with a stick. Nobody seemed resentful and nobody stopped talking. Apparently they looked upon violence as the logical result of their obstructiveness; but not enjoying it, they speedily gathered the necessary band of thirty-five coolies. The latter did not want to go. Who would, if he had to carry a sixty-pound load over roads where even the unloaded "Sahib" grows weary? For six days the same band of coolies trudged through the deep snow, getting the grass sandals on their bare feet soaked with rain and slush the first day, picking their way perilously among old avalanches with new ones roaring all about them the second, burning and blistering their faces in the intense heat and dazzle of the succeeding clear day, and on the fourth, after a night in a rest-house full of smoke, tramping over the hard, smooth

crust in the clear light before sunrise to the top of the Himalayan pass of Zoji La, 11,300 feet above the sea.

The men's wages, according to the official scale, were eight cents a day, except for especially hard stretches, where they got ten. As nothing is ever paid for the return journey, four or five cents a day was all that they were entitled to for the most exhausting labour; but the means of supporting life in Kashmir are so cheap that with this they were able not only to pay for their own food, chiefly bread and rice, but to support their families. In spite of their unwillingness to go, the men seemed cheerful in their stolid way, and chattered like magpies when they came in for the night. A present of a little tea all around made them quite jovial.

The bearing of burdens by coolies is a necessity if communication is to be kept up among the snowy mountains of Kashmir; but its influence is distinctly bad, encouraging brutality and violence on the part of employers and engendering deceit, laziness, and selfishness in the men-of-burden. Our coolies engaged in regular fights for the lightest loads, and some of the more clever ones constructed mock loads by wrapping a rope or some other light, bulky thing in cloth and staggering off with it. Nothing but Government compulsion could make them do the work except for exorbitant hire, although they are accustomed to carry their own loads on their backs. If the people should become more educated or more independent, they would refuse to act as coolies, and some new means of transport would be necessary. Among the changes which will in time come to Kashmir the introduction of a new system of transportation among the snowy mountains may perhaps be reckoned; for, on the one hand, education is beginning to spread, though as yet it is largely limited to the cities, and, on the other, the demand for coolie labour and the disinclination of the people to perform it are increasing with the growing invasion of Kashmir by English tourists and sportsmen.

The old order is passing away in the Vale of Kashmir, and it may not be long before the simple geographic conditions produced by the long and undisturbed residence of a homogeneous race in the seclusion of their mountain-girt basin will give place to the complexity arising from the mixture of races and the invasion of new habits and ideas. Since the opening of the new wagon-road down in Jhelum, external trade and intercourse of all kinds have received a powerful impetus; and when the projected electric railroad, run by power from the Jhelum, is completed, the isolation of Kashmir will be largely destroyed. Pronounced changes in trade, and in the distribution, habits, industries, and even character, of the natives, together with

the development of a new and relatively permanent English element of population, are likely to follow; and the Kashmir of the future will be much more complex than that of the past.

Part II.—The Climate of the Past.

In geographical and historical works it is generally assumed that at least as far back as the beginnings of written history, the climate of past times has been practically uniform. The basis for the assumption is largely a matter of opinion, without definite proof one way or the other. In the desert regions of northern Africa and western and central Asia, there are many places where the water supply of antiquity, as indicated by the size of ancient ruins and lakes, or by the amount of former vegetation, appears to have been greater than that of to-day. The phenomena have usually been explained on the hypothesis that the apparent decrease in the amount of water is due to human factors, such as the abandonment of irrigation works because of war, misgovernment, or disaster, the cutting off of forests, and the diversion of rivers from one region of irrigation to another. A second hypothesis holds that, even though there be no change of climate, deserts by their very nature must continually expand, eating up or corroding, as it were, the habitable areas on their borders. A third hypothesis postulates local changes of climate which affect only small areas and, so far as the hypothesis is concerned, are unrelated to each other or to any generally-known processes or events. Lastly, according to a fourth hypothesis, which I have set forth in the Reports of the Pumpelly Expedition,* and in an article recently published in the *Geographical Journal*, the climatic changes which characterized the Glacial period have continued with decreasing severity down even to the present day. Other evidence, which is shortly to be published, suggests that, while the general tendency from early historical times onward has been more or less rapidly toward greater aridity, there may have been at least one period of partial recovery during which the withering rivers of desert regions increased in volume and length, vegetation became more abundant, and the advance of deserts was checked or reversed for a time, only, however, to begin again when the climate once more tended toward aridity. Stated more concretely, but with the proviso that the statement is highly tentative, the

*Exploration in Turkestan. Publication No. 26 of the Carnegie Institution of Washington, Washington, D. C., 1905.

hypothesis may be expressed as follows: The facts at hand in the drier regions of western and central Asia suggest that during the last few thousand years the climate has gradually become more arid. The general tendency toward aridity appears to have been accentuated by an unusually dry epoch somewhere in the first thousand years, more or less, of the Christian era, after which it was probably interrupted by a slight mediæval increase in humidity or cold, although at present a tendency toward aridity again seems to prevail. The inferred changes of climate are of especial significance because they seem to have coincided with and to have been the cause of some of the chief events of history.

In the present article it is not possible to examine the four hypotheses, or any one of them, in full. I propose to investigate the question of whether there is any evidence of changes of climate in Kashmir, or whether all the facts can be explained as consistent with an unchanging climate. If the answer affirms the probability of changes, further inquiry becomes necessary in order to decide between the third and fourth hypotheses—that is, as to whether the supposed changes have been local or widespread, a question which can be answered by a study of the extent of the agreement of details in far-separated regions. Previous discussions of the climate of antiquity have dealt almost exclusively with arid regions. Kashmir, on the contrary, is a comparatively moist region, with abundant vegetation, and hence any evidence which it may present is of unusual value.

In arid regions the types of evidence upon which the hypothesis of an historic change of climate is based consist of various classes. One class, dealing with the relation of climate to life, includes, on the one hand, ruins of ancient cities and irrigation works in places where there now appears to be no sufficient water supply; and, on the other, extensive areas of dead or dying vegetation. Another class dealing with the effect of increasing aridity upon surface water, includes withering rivers and springs and enclosed lakes inferred to have decreased in size. Still a third class concerns itself with the influence of changes of climate upon the form of the earth's surface. It deals chiefly with fluviatile terraces or other deposits which happen to be so placed that it is possible to ascertain their date with reference to man. A last class consists of the type of evidence found in historic and legendary records. It is evident that in a region like Kashmir, where water and vegetation are still abundant and the rivers and lakes discharge to the sea, the first two classes of evidence can find no place. Our inquiry must be

limited to a comparison of terraces and allied phenomena on the one hand with legendary and historic records on the other.

The Jhelum, which, it will be remembered, is the main river of Kashmir, and all of its chief tributaries which I saw—namely, the Kunhar, Kishen-Ganga, and Sind—wherever they flow in well-defined mountain valleys are bordered on either side by a series of fluvial terraces composed of gravel, and rising to a height of five to five hundred feet above the stream. In order to understand the relation of the terraces to the problem of the climate of the historic past, it is necessary to gain a clear conception of their cause. Hence a somewhat technical physiographic discussion is necessary before we can pass on to the human side of our subject. Three hypotheses present themselves in explanation of the terraces of Kashmir. According to one, the terraces may be due to changes in river action, due to the enlarged glaciers of the Glacial period, which scoured out the heads of the valleys so vigorously that the streams could not carry away all the detritus. Hence the bottoms of the valleys were filled with the detritus in the form of deposits of gravel. When the glaciers retired, and the load of the streams was correspondingly lessened, the rivers were able to cut into the gravel deposits in the bottom of their valleys and thus to form terraces. A second hypothesis attributes the terraces to warping of the earth's crust, whereby the streams were at first retarded and caused to aggrade their beds by covering them deeply with gravel and silt, and later were accelerated and induced to deepen their channels and form terraces. These two hypotheses are familiar to all students of physiography. In "Explorations in Turkestan" I have presented a third hypothesis, to the effect that the terraces are due to the changes of climate which gave rise to the Glacial period, although glaciers *per se* had nothing to do with the matter. As the hypothesis is not yet familiar to most readers, and as it appears to fit the facts in Kashmir, I shall devote a few paragraphs to its elucidation after showing why the other two hypotheses are inadequate.

The accompanying sketch (Fig. 1) represents the profile of the Jhelum river from near its head, *A*, in the middle range of the Himalayas, across the plain of Kashmir, through the Wular lake, and across the front range of the Himalayas, *C*, to the plains of northern India. The unshaded portion represents the solid rock below the bed of the river. The heavily shaded portion represents deposits of gravel which have been dissected into a terrace; and the lightly shaded upper portion represents the mountains through

which the gorges of the Jhelum are cut at *A* and *C*, and which surround the plain of Kashmir. Although the upper surface, that is, the smooth top, of a given terrace on any of the

FIG. 1—IDEAL LONGITUDINAL SECTION OF THE JHELUM VALLEY.

observed rivers of Kashmir descends steadily, as shown in the profile, its height above the stream varies, being greater where the valley sides rise steeply to a great height, as at *A* and *C*, becoming less as the mountains diminish in height and steepness, and being reduced almost or completely to nothing in flat plains, such as that at Kashmir, *B*, where the mountains retire far from the river. If the terraces were due to the erosive activity of glaciers, they, that is the terraces, would be highest at the head of the valley, *A*, close to the glacial source of their component gravels. They would diminish in height downstream toward the plain, *B*; but they could not revive again in the lower range, *C*, where there have never been any glaciers competent to supply the required rock waste or gravel. Hence we conclude that the variation in the height of the terraces above the stream in response to the character of the valley sides, involving their revival to great size after having been reduced almost to nothing, shows that they cannot be due to any cause such as glaciation acting at the head of the valley, *A*, but not among the lower mountains surrounding *C*.

The possibility that the terraces are due to warping of the earth's crust is not absolutely excluded by the facts at Kashmir, so far as I saw them. It is rendered improbable, however, by the fact that terraces of the same relative size and order are found on independent streams flowing in opposite directions down either side of both the front and main ranges of the Himalayas, and on streams such as the Jhelum and Indus, which flow southward across one or both ranges. If the terraces are due to warping, it means that during the most recent geological times both ranges for a distance of hundreds of miles must have been subject to small up-and-down movements which preserved the same relative intervals and intensity over the entire area. Such a supposition is contrary to the very local and variable character of earth movements now

taking place—for instance, the San Francisco earthquake, where the intensity of the dislocation and even the direction varied from place to place. Moreover, earth movements of the past recorded in faults, or dislocations of the earth's crust, usually appear to have involved motion chiefly in one direction, rather than repeatedly up and then down, as must have been the case if such movements are responsible for the alternate cutting and filling seen somewhat among the Himalayas, and still more in remoter regions, where, most significantly, the terraces are almost identical with those of Kashmir.

If we are right in concluding that the terraces cannot be due either to glacial action, or to warping of the earth's crust, the only alternative appears to be that they are due to changes of climate. Such an hypothesis is supported by the uniformity of the terrace phenomena over vast areas. In Persia, Transcaspia, and Russian Turkestan, as I have shown in the reports of the Pumpelly Expedition, the terraces of the main valleys leading from the higher mountains present a marked degree of uniformity in structure, arrangement, number, appearance, and relative size. In north-western India and in Chinese Turkestan, both among the Kuen Lun Mountains on the south and the Tian Shan Mountains on the north, the same is true. From Persia on the west to China on the east the typical series of terraces consists of three which are old and large and comparatively dissected, two which are much smaller, younger and better preserved, and a still smaller one, often absent, which may be called incipient. Sometimes there are traces of one or two terraces older than any of those just mentioned.

We are apt to think of the Glacial period as, primarily, a time of intense glaciation. Such a view is inadequate. Glaciation was a phenomenon whose distribution in space was limited to the northern half of Europe and North America, and to a few elevated regions in other parts of the world. Its distribution in time was limited to the five or more glacial *epochs* which formed half of the Glacial *period*, the other half being composed of *inter*glacial epochs, during which the climate was so far ameliorated that the glaciers retired as far as their present position, or farther. Thus the Glacial period was, primarily, a time of *climatic change*. It consisted of alternating epochs of colder or moister climate on the one hand and of warmer or drier climate on the other. In non-glaciated regions one of the most notable features of the colder or moister epochs must have been an increase in the size of rivers analogous to the increase in the size of glaciers in glaciated regions. Hence, such epochs may

fitly be termed "fluvial" when we speak of regions where rivers increased in size, just as they are called "glacial" in regions where glaciers increased in size. The use of the word "fluvial" is advisable in order to avoid the implication of glaciation involved in the more common word. Accordingly, when referring to non-glaciated regions I shall use the terms "fluvial" and "inter-fluvial" and their derivatives as the designations of the contrasted climatic epochs ordinarily known as "glacial" and "interglacial" in Europe and America. The new terms imply nothing as to the cause of the epochs under discussion. The exact cause of the Fluvio-Glacial period is as yet unknown. It may have been due to alternating conditions of relative cold and heat or of increased and decreased precipitation, or of more or less cloudiness, or to a combination of any two or all of these possibilities. In using such terms as moist, cold, humid, dry, warm, arid, and the like, I do not mean to imply anything one way or the other as to the cause of the Fluvio-Glacial period.

Whatever the cause of "fluviation" may have been, it seems safe to say that in non-glaciated regions, such as most of Central and Western Asia, a fluvial epoch was a time of increased humidity, because of either increased precipitation or a diminished evaporation. In either case the size of rivers, springs, and enclosed lakes would increase, and the soil would be more damp than in an inter-fluvial epoch such as the present. Under such conditions the processes of weathering or rock decomposition would be more active. Therefore, in places where the underlying rock was not already protected by a thick layer of soil, weathering would proceed rapidly until such a layer was formed. In regions which are now arid this would be especially true. Under conditions of aridity, plants are so scarce that the soil is not held in place, even on very gentle slopes. It is washed away by occasional torrential rains almost as fast as it is formed. Increased humidity would cause an increased growth of vegetation, the roots of which would be effective agents in holding in place the new soil and half-decomposed rock produced by the more rapid weathering.

One objection must be met at this point. There can be but little doubt that fluvial conditions would cause a deeper accumulation of soil in regions which are now warm as well as dry. It is conceivable, however, that in regions which are now *cold* and dry, the possibly increased degree of cold might diminish the amount of vegetation so that the thickness of the cover of soil would grow less rather than increase. In certain places this might occur, but

not often. Botanists agree that lack of water is far more injurious to plant growth than is lack of heat. The dependence of vegetation upon favourable conditions of moisture rather than of temperature is well illustrated by a comparison of two regions which I saw in Central Asia. The western part of the Tian Shan Mountains in the vicinity of Son Kul (left-hand lake) lies in latitude 42°, eight degrees north of Ladakh in the Himalayas.

Both regions lie at the same altitude of 10,000 to 11,000 feet; and if the moister parts of Ladakh, such as the Dras Valley north of Kashmir, be included, the precipitation is not widely different. But Son Kul is a cold place, where snow lasts eight or nine months, and there are frosts in July; while most of Ladakh has snow for scarcely three months, and is so warm that apricots can be raised, and snow remains for scarcely three months. Yet, when I visited Son Kul as a member of the Pumpelly Expedition, I found that because of the low temperature there was but little evaporation and the ground was very moist. Consequently the mountain slopes in July were covered with a thick protective growth of turfy grass, full of the most delicate spring flowers and dotted with scores of the felt tents of nomadic Kirghiz and with literally thousands of cattle and sheep. As might be expected, the soil, thus protected and held in place, was deep. In Ladakh, on the contrary, in May, as is true throughout the year, the dry, hot slopes were almost naked, and the few sheep of the hardy villagers were browsing on scattered burtse and other sparse plants of the sage type. The disparity between the two places, both as to vegetation and soil, was out of all proportion to the disparity in precipitation. If Ladakh were to become as cold as Son Kul, there would be much less evaporation, and the vegetation would approximate to that of Son Kul. Naturally, an increase of precipitation would cause a similar result. Thus, except in extremely cold regions, a fluvial epoch, whether due to greater cold or greater precipitation, would be a time of more abundant vegetation, which would hold the soil in place.

Let us suppose now that during a fluvial epoch a mountainous country, more or less arid, as the case may be, has become somewhat thickly covered with soil. If now an interfluvial epoch should ensue, there would be an approach toward aridity, even though conditions might not be extreme. Part of the vegetation would gradually disappear, and the tendency to sudden and violent floods would increase. Consequently, the soil and rock fragments covering the mountain slopes would be more exposed to erosion and

would be washed down to the valley bottoms. The amount of material thus provided would be so large that the streams would be overloaded and could not carry it all away. Thus the valley bottoms would become areas of deposition. In time, however, the slopes would be stripped of all loose material, or else an epoch of greater humidity would again prevail, and vegetation would increase so as to check the carrying away of the soil. In either case the streams would not have so heavy a load of detritus as formerly, and would begin to cut into the deposits of relatively loose material at the bottoms of their valleys, thus forming terraces. By repeating the processes of deposition and erosion, an indefinite number of terraces might be formed, provided each repetition was less effective than its predecessor, whose work it would otherwise conceal.

The theory which has just been outlined must now be applied to Kashmir. In the gorges of the Jhelum a complete series of terraces is developed. In the plain, however, the two lower terraces are rudimentary or lacking; while the upper ones take the form of "karevas," the long tabular slopes of gravel mentioned in the general description of Kashmir. Their structure is illustrated in Fig. 2, an ideal section across the plain from north-east to south-west. Apparently, at the end of one of the main fluvial epochs, when much loose soil and broken rock had accumulated on the mountains, a more arid interfluvial epoch with a fairly dry summer climate like that of to-day ensued, causing vegetation to diminish somewhat and allowing the weathered mantle of rock to be washed down to the plain, the level of which was thus raised to 1 (Fig. 2). During a succeeding epoch, part of the material thus deposited was cut away by the river, leaving a "kareva," *A*. Probably the process was repeated several times, for in various places, there are traces of three terraces, as we saw on the spur at Baramula, or at Srinagar on the isolated temple-crowned hill of the Takht-i-Suliman (Throne of Solomon), a thousand feet high.

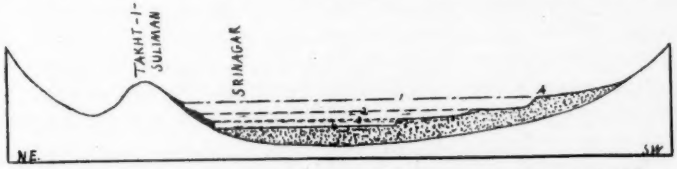


FIG. 2.—IDEAL CROSS-SECTION OF THE KASHMIR PLAIN, SHOWING ITS CHARACTER AS A BASIN PARTLY FILLED WITH FLUVIATILE DEPOSITS, AND ALSO THE KAREVAS, OR TERRACES.

On the side of the Takht-i-Suliman, as appears on the left of figure 2, the terraces are mere remnants, the narrow, steeply-sloping

stumps of piedmont slopes composed of fine soil and bits of angular talus derived from the mountain-side behind them. Apparently the "karevas" and the remnants of terraces on the Takht-i-Suliman correspond to the three upper terraces of the gorge of the Jhelum farther down stream, and are too old to have any ascertainable relation to man. They are important, however, because, taken in connection with the terraces of neighbouring streams and with those in other parts of Asia, they illustrate the mechanism of terrace-making, and tend to show that the phenomena were practically identical throughout central Asia, and hence were probably due to a single widespread cause, which appears to have been the climatic oscillations of the Glacial—that is, the fluvial—period.

Turning now to our immediate problem, the relation of climate to man and history, my brief study of Kashmir did not reveal any instances where ruins or other traces of early human occupation are directly associated with terraces in such a way that the one can be dated in reference to the other. Certain legendary and historic accounts, however, seem to indicate that during the last two or three thousand years the conditions of human life have been considerably affected by changes of climate, which appear to be the same as the ones giving rise to the lower terraces. Stein (1899, pp. 65, ff.) relates a tradition prevalent as long ago as the time of the Chinese pilgrim Hiuen Tsiang in the seventh century and recorded in full by Kalhana in the twelfth century. According to it, the demon Jalodbhava (Water-born) resided in a lake which then covered Kashmir. He caused great distress to all neighbouring countries by his devastations. Kasyapa, the father of all fountain-gods, hearing of this from his son Nila, the king of the Kashmir fountain-gods, promised to punish the offender, and proceeded to the seat of Brahma to implore his aid and that of the other gods. His prayer being granted, the whole host of heaven took up their position on the lofty peaks about Kashmir, and ordered Jalodbhava to leave his watery home. This the demon, who was invincible while in the water, refused to do. Vishnu thereupon called on his brother, Balabhadra, to drain the lake by piercing the mountain with his weapon, the ploughshare. When the lake had become dry, Jalodbhava was attacked by Vishnu, and, after a fierce combat, slain with the god's war-disc.

Kasyapa then settled the land of Kashmir which had thus been produced, the gods as well as the fountain-spirits taking up their abodes in it, while the various goddesses adorned the land in the shape of rivers. At first men inhabited the land only during the

six summer months, and withdrew to warmer regions each winter, leaving Kashmir during the cold season to the Pisacas, the vilest and most malignant of Hindu demons. At length, however, after four yugas or ages the Brahman Caandradera learned certain rites which freed the country from the Pisacas and from excessive cold; and Kashmir became habitable throughout the year. Stein (1899, p. 66) and Drew (p. 207), two of the most careful writers on Kashmir, regard this tradition as not founded on historical fact, but on inference from the lake-like appearance of the basin and from the fact that during floods Lake Wular is subject to considerable fluctuations in size. It is possible that the legend of an ancient lake, drained by the ploughshare of a god, might rise in this way, but there is nothing in the physical features of Kashmir to give rise to the circumstantial details of the great cold of antiquity, the long prevalence of winter, the occupation of the country by nomads at first during only half the year, and its later change to conditions adapted to agriculture. The circumstantial character of the legend and the agreement of the details with physiographic facts in Kashmir and elsewhere, as will shortly appear, give ground for supposing that the story may be founded on fact.

Another legend, also quoted by Stein (1899, p. 115), relates how, after the drying up of the lake, the site was occupied by a town called Candrapura. A certain holy man coming to the town and being refused entertainment, cursed it and foretold its destruction by water. Later a fountain-god, who visited the country in the guise of an old Brahman, asked and obtained permission to settle in the town, and then out of gratitude revealed himself in his true form and warned the king of the prospective submersion of the city. The king and his people accordingly migrated a short distance westward and, under the god's direction, founded a new town. Then the god took up his residence in the lake, which soon overwhelmed the old city. The natives say that ruins, supposed to be those of this city, have been seen at the bottom of this lake.

Turning now from legend to better-attested history, it appears that Kashmir, now and always, has suffered more or less from famine, due, not to drought, as in so many countries, but to floods, which drown the rice crop. In the time of King Avantivarman, A.D. 855–883, as Stein (1899, p. 108–109), on the authority of Kalahana, relates, Kashmir had long been suffering from peculiarly disastrous floods of this sort and from the general water-logged condition of the country. Many attempts had been made to mend matters, and at last, to quote Stein, "Suyya, a man of conspicuous

talents but low origin, offered to remedy the troubles. The operations commenced at Yaksadara, where large rocks, which had rolled down from the mountains lining both river-banks, obstructed the Vitasta (Jhelum). . . . Yaksadara, the present Dyaragul, is a spur projecting into the river-bed some three miles below the commencement of the Baramula gorge. Its rocky foot forms the first rapid of the river (after it leaves the Kashmir plain). By removing the obstructing rocks the level of the river was lowered. Then a stone dam was constructed across the bed of the river, and the latter thus blocked up completely for seven days. During this time the river-bed was cleared at the bottom, and stone walls constructed to protect it against rocks which might roll down. The dam was then removed, and the river flowed forth with increased rapidity through the cleared passage: I must leave it to competent engineering opinion to decide to what extent and at which point of the Baramula gorge the operations so far described were practicable with the technical skill of that age. What follows in Kalhana's account is so matter-of-fact, and so accurate in topographical points, that a presumption is raised as to the previous statements, also resting, partially at least, on historical facts."

Yaksadara, where the operations were carried on, lies directly opposite the mouth of a large stream which, in the ten miles from its source near Gulmarg, descends 7,000 feet. It appears as though, at the time of Avantivarman, the large fan of this stream had encroached upon the Jhelum and raised its level, just as has happened at many other places lower down—for instance, at Uri, where the front of the fan was in later times cut off by the river. The process of cutting off the front of the Yaksadara fan, though begun artificially under the direction of Suyya, probably continued naturally during later centuries; for the level of the Wular Lake appears to have fallen steadily, as though the river were slowly deepening its channel by cutting away the fans and other material in the bottom of its valley, thus forming a terrace. In proof of this fall of the lake level Stein (1899, p. 113) cites certain villages which Kalhana, 1148 A.D., seems to indicate as having been actually reclaimed from the lake, and which Jonajara, *circa* 1450 A.D., still places on its very edge, although now they are three miles from its border. Similarly, Srivara, *circa* 1480 A.D., speaking of the neighbouring villages stretching from Sudarkoth (Sadykoot) to Andarkoth (Andykoot), seems to place them along the shore of the lake, although they are now from four to six miles away. Stein attributes the change in the relation of the villages to the lake to

the building up of the delta of the Jhelum, where it enters Lake Wular. This cause, however, though doubtless operative, seems inadequate to produce such great results, especially when it is considered that some of the marshy regions to the south of the lake away from the delta have also become drier. The chief cause is probably the lowering of the level of the lake by the deepening of the outlet channel—a process which has surely taken place not many centuries ago, as is proved by the freshness of that which Stein (1899, p. 116) calls the "winding but well-defined bed" which the river has cut in recent times—and is, perhaps, still deepening—from the outlet of the lake to the head of the gorge.

Putting aside all unnecessary details, the following outline of events appears to fit the legends and facts related in the last few paragraphs. Long ago, in prehistoric times, the basin of Kashmir contained a lake much larger than that of to-day. The lake was partially drained by the deepening of the channel at the head of the gorge of Baramula, where, it should be remembered, the river would encounter only unconsolidated deposits. After this, or at this very time, the climate was so cold, or the winter snows were so abundant and lasted so long, that the country could be inhabited only in summer by nomads who migrated southward in winter. In time, however, the climate moderated, and Kashmir became the abode of a permanent and prosperous agricultural community. At the height of its prosperity a new difficulty appeared. By reason of the building up of the bottom of the gorge near Baramula. the lake began to expand again, and to overwhelm inhabited villages. Many attempts were made to remedy matters, and success was finally attained, after which the river itself was able to deepen its channel, instead of letting itself be checked by the waste brought in by its tributaries.

The size of the legendary lake of the earliest tradition suggests at first thought that the water supply then was larger than at present. According to the theory of terraces, already outlined, however, this is not necessarily the case; the lake would be most likely to expand in a dry epoch. It is not a question of water supply, as in the case of salt lakes in enclosed basins, but simply of how the Jhelum River came to be so checked that a small portion of its superabundant water was detained in a lake. At present Wular Lake is about twelve miles long north and south by about six east and west, and, according to Stein, has a maximum depth of fifteen feet. It is surrounded on all sides by alluvial deposits, which have been built up in such a way as to leave at the base of the

northern mountains the faint hollow in which the lake lies. The formation of the broad dam, so to speak, which holds back the lake, may probably be attributed, in part to the deposits laid down during seasons of flood by the Jhelum itself, and still more to the deposition of fans by the tributaries which come in from the north and south near the mouth of the Baramula gorge. In a slightly moister epoch the forces of erosion would be less active upon the mountain slopes, because of their thicker cover of vegetation ; the streams, though large, would not be very heavily loaded, and the tendency would be to cut away the fans and similar deposits which had previously been laid down and to drain the lake. On the advent of a drier epoch, on the other hand, the forces of erosion would be more active upon the mountain slopes, and the average size of the fragments carried away would be greater because of the diminution in vegetation and in the number of roots which would hold the soil in place; the streams, especially the shorter, steeper tributaries, would be not only more heavily loaded, but also smaller; and the valley bottoms, with their comparatively gentle slopes, would become areas of deposition. Where the swifter tributaries joined the slower main stream they would tend to build up fans which the main stream, also diminished in volume and more heavily loaded, might not be able to remove. Thus the fans would form dams ; and, paradoxical as it may seem, lakes would tend to be formed in drier epochs and to be drained in moister epochs. The process would be simply another phase of the terrace-making process already discussed.

If now our conclusions as to terraces and lakes, on the one hand, and the physical history of Kashmir, as inferred from legend and history, on the other, be compared with the interrupted progress of desiccation suggested by the facts in remoter regions, it will be seen that the three lines of evidence agree quite closely. The terraces seem to indicate a succession of climatic oscillations, during the drier phases of which the basin of Kashmir was probably occupied by a large lake which was drained during the moister phases. No absolute proof of such a lake has been found, however; for though Drew and others have thought that the "karevas" —the tabular deposits of silt and gravel already discussed—were lacustrine, recent investigation in other regions has shown that such deposits are usually largely of fluvial origin, though small lacustrine portions are not uncommon. The earliest legend demands a large lake; physiography gives no direct evidence of such a lake, but says that there is a high degree of probability that

something of the sort may have been formed during a dry epoch. Hence we may provisionally accept the hypothesis that during the last interglacial or interfluvial epoch of comparative dryness a lake was formed which persisted long enough to be seen by early man.

Evidence as to the succeeding epoch is more definite and more completely in agreement. The legend points to a cold period during which Kashmir was not habitable in winter, and during which the lake which occupied the plain was drained by the cutting of a deeper channel. Physiographic evidence, as we have seen in the discussion of the paradoxical origin of lakes, seems to show that if there were a lake larger than that of to-day, it was probably drained during one of the moist epochs of which the terraces furnish independent evidence. In Transcaspia, Persia, and Turkestan, other lines of research give ground for the hypothesis that two thousand or more years ago the water supply was decidedly larger than now, and the desert regions were more habitable. Putting together all these conclusions, there seems to be reason for believing that a fluvial epoch, culminating somewhere in remote antiquity, had not yet wholly passed away at the beginning of the Christian era, and may have been the time indicated in the legend when Kashmir was too cold to be inhabited, except in summer, by nomads. Even to-day the snowfall of Kashmir is so great that agriculture cannot be carried on at an elevation of much over 7,000 feet, and on the plain itself, at an elevation of from 5,000 to 6,000 feet, early snows sometimes cause disaster by destroying the rice crop. It would need but a slight increase in cold or in snowfall to render the whole country unfit for agriculture and only habitable for nomadic shepherds, who would drive their flocks southward in winter, away from the snow, to the warm, low plain beyond the mountains; and such we may reasonably believe to have been the condition of Kashmir before it appears in history near the opening of the Christian era.

By the sixth or seventh centuries of that era, as history shows, Kashmir had acquired nearly its present prosperous character, and not long after was suffering from the filling of the channel of the Jhelum with detritus from the mountains and the consequent expansion of the lakes. Such prosperity and such disaster would naturally result from a relatively dry or warm epoch such as that which is supposed to have accentuated the general tendency toward aridity during the first six or eight centuries of the Christian era. On the one hand, agriculture would be stimulated, and, on the other, fans of boulders and gravel would be deposited in the river bed, causing the lake to rise, and perhaps to submerge villages.

As to the possible succeeding mediæval interruption of the tendency toward aridity there is little to be said. The deepening of the channel of the Jhelum, and the slight lowering of the level of the Wular Lake are the results to be expected under such circumstances, as are also the famines, which Stein (1899, p. 119), on the authority of Kalhana, describes as taking place in the twelfth century because of prematurely early snowfalls. Similarly the complete freezing over of the Jhelum, described by Kalhana in 1087–8 A. D., and the extreme isolation of Kashmir during the Middle Ages, would be natural if the winters were more severe and the passes more snowy than now.

Altogether, the human history of Kashmir shows a fairly close agreement with the physical history as inferred from the terraces and from their relation to those of other regions. The evidence thus far discovered affords some slight but most interesting indications of the possibility of an acceleration of the process of desiccation during the first part of the Christian era, and of a reversal of the process during the succeeding mediæval ages. Its chief importance, however, lies in the fact that here, in the fairly moist region of Kashmir, in India, south of the main range of the Himalayas, just as in the arid regions far to the west, north, and east, there are somewhat distinct indications that desiccation has actually taken place—that is, that there has been a transition from colder or damper climatic conditions, two thousand or more years ago, to warmer or drier conditions to-day. The transition appears to be part of a widespread change of climate presenting the same general features as the more intense fluvial or glacial epochs of earlier times, and extending at least from Persia and the Caspian Sea on the west to the borders of China proper, three thousand miles away, on the east. In Kashmir, at least, the change seems to have had a notable effect upon the habits and distribution of man, and thus upon his whole development.

COMMANDER PEARY'S ARCTIC EXPEDITION.

The first news of the safe return of Commander Peary and his expedition from the Arctic Ocean north of Greenland was received in a message he sent from Hopedale, Labrador, *via* Twillingate, Newfoundland, Nov. 2. His ship, the *Roosevelt*, had lost two propeller blades, and was otherwise injured. On Nov. 23 the *Roosevelt* arrived at Sydney, C. B., having taken the inside passage through the Strait of Belle Isle and across the Gulf of St. Lawrence. She had stopped at several ports for coal.

The New York *Herald*, on Nov. 21, published a very long cable despatch sent by the explorer from Chateau Bay, Labrador, describing in outline his work in the Arctic and his attainment of latitude of 87° 6′ north, within about 200 statute miles of the pole, which surpasses by thirty-eight statute miles the record of the "highest north" made in 1900 by Captain Cagni of the Duke of the Abruzzi Expedition to the north of Franz Josef Land. Commander Peary's sledge journey to within 200 miles of the pole is the most remarkable on record; and this, with his other experiences and achievements, will give his results a distinctive chapter in the history of Polar Exploration.

Leaving Etah after midnight on Aug. 16, 1905, the *Roosevelt* steamed in open water to Cape Fraser, beyond which she was driven back by ice, but finally reached an open channel close along the Greenland coast, in which she ran to Thank God Harbor. After very severe tussles with the ice the vessel was forced across the mouth of Robeson Channel to Cape Sheridan, which became her winter quarters, about four miles northwest of those of the *Alert* in 1875–76. This position was attained in twenty days from Cape Sabine.

By Oct. 1, one hundred musk oxen and deer had been secured. During that month a considerable number of the dogs died, and it was found they were being killed by cured whale meat that had become poisonous. Peary thus faced the problem of wintering his Eskimos and dogs on the resources of the country. He sent all his dogs and most of the natives in charge of Marvin and Henson south about seventy miles in Grant Land, where they lived in snow houses in the Lake Hazen Basin and along the slope of the United States Range, subsisting upon musk oxen, reindeer, hare and salmon trout.

The winter was remarkable for comparatively high temperatures. There were some furious gales from the south, and at such times water leads were invariably formed along the coast, some of them two or three miles in width. The ice was in motion nearly all the time. The three weeks after Christmas were a period of great anxiety, with the ice-pack surging back and forth and threatening to force the *Roosevelt* up on the ice-foot.

On Feb. 7 all the Eskimos and dogs were brought back to the ship. Of the 220 dogs, 120 remained. A few days later Capt. Bartlett and a party went to Cape Hecla and found leads of water extending north as far as they could see. There were leads along the Greenland and Grant Land coasts, and the northern part of Robeson Channel was open.

The entire party for the sledge journey to the north was assembled at Cape Hecla, consisting of Messrs. Peary, Bartlett, Wolff, Marvin, Henson, Clarke, Ryan, and 21 Eskimos, with 120 dogs. They were to be divided into one main and five or six division parties, which, the explorer hoped, would be able to advance supplies and maintain communication with a base selected for his final point of departure for the pole. Point Moss, 20 miles west of Cape Hecla, was selected as the point of leaving the land. On Feb. 28, Henson led the pioneer party of three light sledges and was followed on the succeeding days by the other parties. Movements of the ice, leads which had to be circumvented, and rough ice where the path had to be cut by pickaxes, made progress slow.

The first glimpse of the sun was on March 6. About 80 miles from the lands ledging greatly improved, but the leads were more frequent and wider. At 84° 38′ N. Peary came up with the advance parties of Bartlett, Henson, and Clarke, who were stalled by a broad lead extending east and west as far as could be seen. There was no immediate prospect of crossing, and so Bartlett and Clarke were sent back with their sledges to bring up more supplies, leaving the Peary and Henson parties to get across as soon as possible. At this time the Marvin, Wolff, and Ryan parties were bound outward from the land on their second trip. The lead slowly widened; but, after six days, when it was two miles wide, the Peary and Henson parties crossed it on the young ice that had formed. Henson pushed on, while Peary remained a day to establish a cache and leave instructions for the other supporting parties.

In three days Peary overtook Henson in 85° 12′ N., camped in a fog. There was a high wind, which increased to a furious gale, with snow, and they were in camp for six days while the storm

lasted. When it stopped, Peary's observations showed that he had been driven some 70 miles to the east.

Henson was started northward again, and two Eskimos with empty sledges were sent back to meet any supporting parties that might have crossed the lead before the storm and to bring up the cache at the lead. They returned in three days, saying that they had met open water, which they could not cross.

Peary could no longer count upon supporting parties, and decided that whatever was done must be done by a dash, with the outcome depending upon the weather and the condition of the ice:

We abandoned everything not absolutely necessary and bent every energy to setting a record pace. Such snow as the wind had not torn from the face of the floes was beaten and banked hard and the snow had been hammered into the areas of rough ice and the shattered edges of the big floes, so that they gave us little trouble. North of Storm Camp we had no occasion for snowshoes or pickaxes.

The first march of ten hours in the lead, with the compass, sometimes on a dog trot, the sledges following in Indian file, placed us thirty miles to the good. Four hours out on the second march I overtook Mr. Henson in his third camp, beside a lead which was closed. When I arrived he hitched up and followed behind my hurry party. I had with me now seven men and six teams, with less than half loads for each.

As we advanced the character of the ice improved, the floes becoming much larger and rafters infrequent, but the cracks and narrow leads increased and were nearly all active. These cracks were uniformly at right angles to our course, and the ice on the northern side was moving more rapidly eastward than that on the southern.

As dogs gave out, unable to keep the pace, they were fed to the others. On April 20 we came into a region of open leads leading nearly north and south, and the ice motion became more pronounced. Hurrying on between these a forced march was made. Then we slept a few hours, and, starting out again soon after midnight, pushed on till noon of the 21st. My observation then gave 87 deg. 6 min.

I thanked God with as good a grace as possible for what I had been able to accomplish, though it was but an empty bauble compared with the splendid jewel for which I was straining my life. But, looking at my remaining dogs and the nearly empty sledges, and bearing in mind the moving ice and the unknown quantity of the big lead between us and the nearest land, I felt that I had cut the margin as narrow as could be reasonably expected.

My flags were put out from the summit of the highest pinnacle near us, and a hundred feet or so beyond that I left a bottle containing a brief record and a piece of the flag which, six years before, I had carried around the northern end of Greenland.

The wind never ceased for an hour on the outward or the return journey. The southward journey was extremely difficult, and the situation of the party was sometimes critical. An ice bridge spanning a lead gave way under them, and they were set adrift on a floe which carried them steadily east for five days, while the lead was widening. The sledges were used as fuel to cook some of the dogs killed for food, as provisions had about given out. They at last succeeded in crossing the lead on the young ice, which bent under every step, and they saw when they reached the pack on the farther side that their fragile bridge had broken behind them.

On May 12 they dragged themselves into the ice-foot of the north coast of Greenland at Cape Neumayer, where, a little later, they found the supporting party headed by Clarke, which had also drifted to Greenland. The castaways were now foodless, but a herd of seven musk oxen was discovered; and Peary killed them

all, thus averting any danger of starvation. All the parties were eventually reassembled at the winter quarters. Not a man had been lost, and 41 of the 120 dogs survived the spring campaign.

A week after his return to the ship, Peary started west to complete the outlining of the unvisited coast-line in that part of Grant Land. He very briefly refers to this important feature of his work:

At Cape Columbia I killed six musk oxen and climbed the summit of the cape, leaving a record and a piece of the Arctic flag in a cairn. From there west to "Aldrich's furthest," then to the land at the northwest angle of Grinnell Land, on the summit of which, 2,000 feet high, I left another cairn and records. Then across a twenty-mile channel to another land, on the northern summit of which, 1,900 feet high, I left a third cairn and record. Twelve deer were secured on this land.

The return journey was a continuation of bad weather, fog, snow and wind. Our marches were greatly hampered by the innumerable lakes and rivers, formed by the melting snow.

Meanwhile, Mr. Marvin had carried a valuable line of soundings along the north coast of Grant Land as far west as Cape Fanshaw, and he and Capt. Bartlett had also completed lines of soundings across Robeson Channel, according to Commander Peary's instructions. The *Roosevelt* had a very severe experience on the southern journey through the Smith Sound channels, and had to be beached at the head of Etah Fiord to caulk the stern, tighten the propeller blades, and prepare the rudder. The Eskimos were landed at various points along the coast which they inhabit. Heavy weather was encountered off Hudson Strait, the rudder was carried away, and another was built and hung with the utmost difficulty. As no coal could be obtained at Hebron, some of the interior beams of the vessel were used as fuel, and small quantities of coal were obtained later at several ports on the way south. The explorer has this to say about his men and his ship:

Tidal observations, entirely by Mr. Marvin, and meteorological observations, principally by him, were made during the year.

Valuable soundings were made by Messrs. Marvin and Bartlett. Dr. Wolff has looked after the health of the expedition with unremitting care and skill and there has been no serious illness. The Doctor also did his share of the spring sled work. Mr. Marvin, while on board ship during the winter or hunting in the interior and through the spring sledging campaign, assumed his full share of the work.

Captain Bartlett has proved himself invaluable. He has been unsparing of himself in his efforts for the success of the expedition and the safety of the *Roosevelt*. Henson and Percy, my stewards, tried in years of Arctic experience, have again proved their worth. The officers and men have proved interested and willing. Mate Bartlett was in charge of the *Roosevelt* during the absence of Captain Bartlett and myself. Chief Engineer Wardwell, from the time of the failure of our water-tube boilers, two days from Sydney, had a trying and difficult time and has found full scope for his ingenious resources. Two of the firemen—Clarke, of Massachusetts, and Ryan, of Newfoundland—took an active part in the spring sledge work. Boatswain Murphy was of material assistance in the field.

The *Roosevelt* as a sea boat is equal to one of our typical bank fishermen, handy and dry, for which the fullest credit is due to her builder, CaptainDix. In heavy ice she has been very effective, even with her reduced power, forcing her way through apparently impassable places. Young ice, even of very considerable thickness, she treaded under her with great facility,and under pressures she rose readily and easily. Finally,whatever valuation may be placed upon the work and result of the expedition, these results are entirely due to the generosity of the members of the Peary Arctic Club, and especially to the unfailing interest and efforts of its president, Morris K. Jesup.

Mrs. Peary and her little son went to Sydney to await the arrival of her husband.

GEOGRAPHICAL RECORD.

AFRICA.

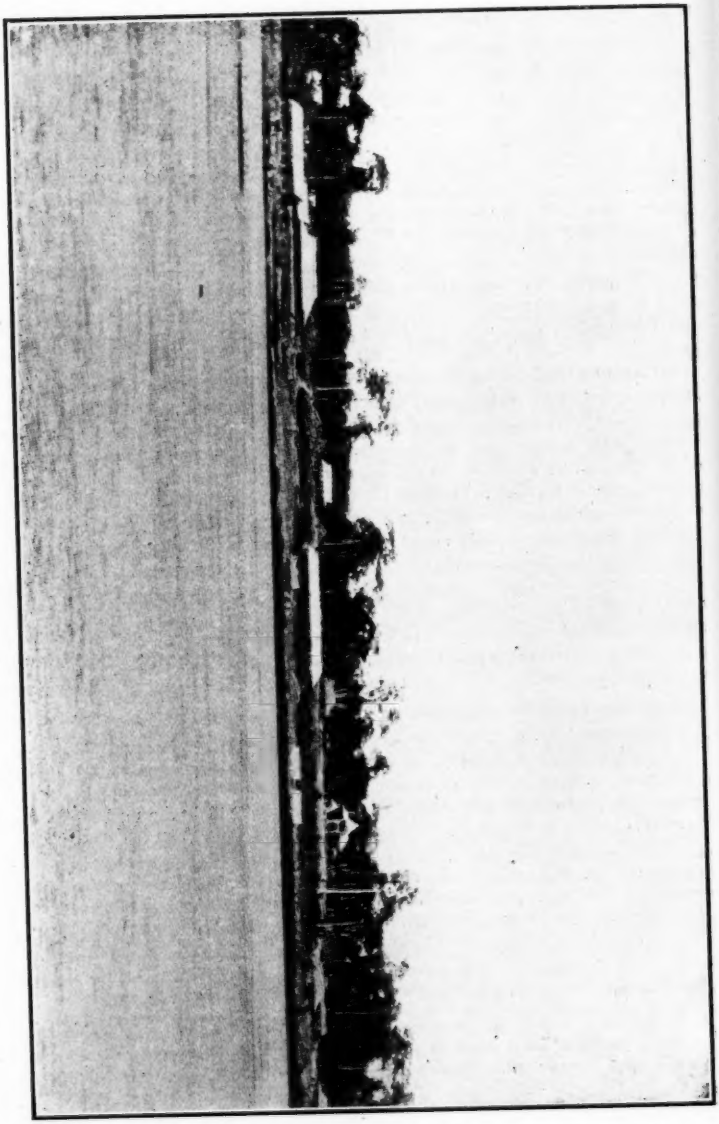
SLEEPING SICKNESS.—The distribution and spread of sleeping sickness in the Congo Free State are treated in the Fourth Progress *Report* of the expedition of the Liverpool School of Tropical Medicine, 1903–1905. The report is written by Dr. John L. Todd, who associates with himself in joint authorship the late Dr. Dutton, head of the expedition, who became a martyr to his devotion to this philanthropic and scientific work. Twenty-three months were spent in the Congo, and some 2,000 miles were traversed by the party. Three maps show the distribution of sleeping sickness in the Congo in 1884 and 1897, and the intensity with which the various districts have been affected by the disease. The expedition found that sleeping sickness follows the main lines of communication, and is often carried into new districts by infected persons.

It is still spreading with terrible rapidity. Cases, probably coming from the west, have already been reported, at Ujiji, on the east coast of Tanganyika; also at the south end of this lake at Moliro, and in the most northerly parts of the Congo Free State at Wadelai and in the Lado enclave. It is recommended, in order to prevent, as far as possible, the spread of the disease, that posts of inspection be established along the main routes leading to uninfected districts in order to prevent infected persons from entering these regions, and that cases of the disease found at posts in uninfected districts be removed to places already infected. It is believed that these measures, if they do not check the advance of sleeping sickness, will at least greatly retard it.

In view of the devastation caused by the sleeping sickness among the natives of the Congo Free State, the King of the Belgians has offered a prize of 200,000 francs to any person who shall discover a cure for the sickness, and also an additional sum of 300,000 francs for the purpose of making researches and experiments toward exterminating the plague.

GEOLOGY AND PETROLOGY OF A PART OF THE CONGO FREE STATE.—Mr. G. F. J. Preumont and Mr. J. Allen Howe have written a paper (*Quarterly Journal* of the Geological Society of London, Aug., 1905) describing what was learned of the geology of the northeast part of the Congo Free State by Mr. Preumont's journey in 1902. The observations were chiefly in the upper Mobangi basin from Tambura and Lado in the north to Wadelai in the south between the Congo and the Nile. They cover only a part of this region, chiefly along the rivers. Granite is the predominating rock. Mr. Preumont demonstrated the absence of fossiliferous deposits in a region where it might reasonably have been expected that they would occur. The abundance of iron in the old crystalline rocks is noteworthy. The investigation extended over 70,000 square miles in a region where a geological survey was rendered difficult and often impossible by the dense vegetation. Mr. Howe contributes a petrological description of the rocks that elucidates Mr. Preumont's observations.

THE NEW CONGO RAILROAD.—The Congo State, on September 1, completed the railroad, 75 miles long, between Stanley Falls and Ponthierville on the upper Congo, thus circumventing the Stanley Falls series of rapids. The railroad around the rapids in the lower Congo between Matadi and Leopoldville, completed in 1898, was built by private enterprise. The new railroad is the first one to be built by the Government. The purpose of the State is to build rail-



STANLEYVILLE.

roads around all the Congo rapids, so that there shall be uninterrupted steam communication between the mouth of the Congo and the head of navigation on the Lualaba head stream of the great river. The entire system of communications will be completed within the next two or three years. Steam communication between the Congo mouth and the end of navigation will then be divided between the land and water routes as follows:

River from Banana to Matadi, 90 miles; railway from Matadi to Leopoldville, 335 miles; river from Leopoldville to Stanleyville, 900 miles; railway from Stanleyville to Ponthierville, 75 miles; river from Ponthierville to Kundu, 195 miles; railway from Kundu to Buli, 276 miles; river from Buli to the head of navigation on the Lualaba, about 300 miles; total length of continuous steam communication on the Congo, 2,471 miles, of which 1,485 miles will be by water

LAYING THE RAILS BETWEEN STANLEYVILLE AND PONTHIERVILLE.

and 986 miles by railway. The inland terminus of the route will be in the southeastern province of Katanga, the richest mineral region of the State, and pronounced by experts to be one of the great future sources of the world's copper supply.

The Congo State has issued a pamphlet descriptive of the building of "Le Chemin de fer du Congo Supérieur," between Stanleyville and Ponthierville. It is well illustrated with half-tone photographs and maps. The grading of the new road-bed began in 1903. The route is entirely through dense forest along the left side of the Congo, and through this forest a clearing was made so wide that the railway and telegraph line cannot be damaged by falling trees. Many of the bridges were built of wood; but these will soon be replaced by steel. Steel aqueducts were employed to conduct small streams under the road-bed. Railroad ties and other timber used in constructing the road were sawed in mills at

various points along the line. The *bombali* tree is believed to yield the best ties that have yet been placed on railroads in tropical Africa. This is a kind of cedar, close-grained and hard, dark, and a little reddish.

Brick clays were utilized for the production of large quantities of brick used in the construction of buildings along the route. Limestone was brought about 100 miles from near the Aruwimi River, and a large amount of lime was burned in kilns near Stanleyville. Most of the white personnel were Belgians, though the directing force also included Italians, Scandinavians, and Swiss. Most of the machinists, masons, etc., were natives trained in the trade-schools of West Africa, who came voluntarily to the Congo seeking work. They were assisted by many young Congolese who had been trained in the trade-schools, maintained by the Government or the missionary societies. From 80 to 160 white men were employed on the line and about 2,000 blacks.

The black workmen lived in native huts, which they could build in a few hours as they moved forward along the line. They had with them their wives and children; for they are more contented and work better when their family life is not broken. The State provided them with ample supplies of rice and salt, the women using much of the salt to purchase vegetables in the native markets. Two physicians were constantly with the force; two hospitals, for the whites and blacks respectively, were maintained at Stanleyville; every sanitary precaution was taken to preserve the general health, and all the blacks were subjected to vaccination. The death-list among both whites and blacks was very small.

The cost of building the line was from 65,000 to 80,000 francs per kilometer. This included the enormous cost of transporting steel rails from Europe—about 12,000 francs per kilometer. As soon as the railroad reached Ponthierville two steamboats were launched on the narrow navigable stretch of the river, and a large force of workmen was taken up to Kindu to begin the building of the third and last railroad around the Congo cataracts.

Climate in the Lake Chad Region.—Recent notes concerning the seasons and winds in the Lake Chad district of Africa, by Audoin, are summarized in the *Meteorologische Zeitschrift*, Vol. 23, October, 1906. From the middle of October to the middle of March northeast winds—the normal trades—prevail, often attaining the velocity of a fresh breeze and producing considerable waves in the lake. After the spring equinox these northeast winds decrease in velocity and regularity, calms and variable winds are frequent; small dry "tornadoes" from the southwest occur, and the temperature rises. In the second half of April the seasonal change is completed; it is hotter; the humidity increases markedly; lightning is seen in south and west; thunder is heard; squalls bring a few drops of rain and the southwest winds set in. These southwest winds are neither as regular nor as strong as those from northeast. There are three seasons. The first, cool, or even cold, from the middle of November to the middle of March, when the northeast trades blow. The temperature maxima are between 79° and 82.5°. In the morning before sunrise the temperature falls 7°-9°, with northeast winds. It is warmer when there is a calm or a southwest wind. The second season is hot. It lasts from the middle of March to the middle of July. The temperature rises considerably, and even the nights are warm. Tornadoes, occasionally with rain, occur over the lake. The third, rainy season, with high water, lasts from mid-July to mid-November. It is then cooler. Tornadoes from different directions bring rains of short duration. The water rises occasionally into mid-December. In 1903 the lake level rose about two feet.

The decreasing depth of the lake is given special attention. This decrease is said to have been going on for decades. The lake has already diminished decidedly in area, and has retreated far from its former shores. The desiccation is general, extending over the whole lake, and not being merely a result of the displacement of the water from east to west, as has been occasionally assumed.

A second paper on the Lake Chad region, by Captain C. H. Foulkes (*Scot. Geogr. Mag.*, Nov., 1906), adds further facts of climatological interest. The climate along the new Anglo-French frontier between the Niger and Lake Chad is comparatively healthy during the dry season, except on the banks of the Niger and on the marshes of the lake, but in the rains it is unhealthy and similar to that on the coast. Europeans became anæmic and enervated, and suffer much from malaria and dysentery. In the dry season the air is filled with fine dust borne by the Harmattan, and objects only a quarter of a mile away are often hard to see. The tornadoes above noted can be seen approaching a mile or two away, their "progress being marked by bushes and trees bent over almost horizontally by the wind, and a long line of churned-up sand." This sand penetrates even "water-tight" tin cases. During the rainy season dry river-beds become rushing streams. After the rainy season the pools of water disappear; rivers dry up, and the only water obtainable is from deep wells in or near the villages. A curious case of seasonal migration into the desert is related of the Tuaregs, who inhabit part of this region. The upper class of these people is nomadic, for the most part, and in the wet season retires into the desert with the camels, which cannot live through the rains. R. DEC. W.

RAINFALL BY CALENDAR AND CROP YEARS AT ALGIERS.—The importance of averaging rainfall data by crop rather than by calendar years when studies of crop production are undertaken is clearly emphasized in a recent study of the rainfall of Algiers from 1868, to 1905, by Ch. Rivière (*Met. Zeitschr.*, Oct., 1906). When the crop year is taken as the basis of the rainfall summary (Sept. 1-Aug. 31) there is a fairly constant relation between the measured precipitation and the harvest. The calendar year 1873 had a normal precipitation of 27.44 inches, which does not in any way explain the actual crop conditions of that year. If, however, the year is begun with September the annual rainfall is 18.92 inches, the lowest in the thirty-seven years of observations. Similarly, in 1881, the calendar year gave 27.90 inches, which does not explain the crop failures and resulting famine of that year. The crop year September, 1880-August 31, 1881, gives the small amount of 19.08 inches, which was insufficient for a good crop. The spring rains from February 15 to May 15 are critical for agriculture in Algeria. After that time a favourable distribution rather than the amount of the rainfall is important. The crop year 1904-05 had a heavy precipitation of 32.39 inches; but the crop was poor, because between March 15 and May 15 the rainfall was deficient. The July and August rains are infrequent and small. In some years these months are rainless. R. DEC. W.

RADIATION PHENOMENA IN SOUTH AFRICA.—Over the bare surface and in the dry air of the Orange River Colony, whose average height above sea-level is over 4,000 feet, local meteorological phenomena which depend upon radiation from sun and from the earth's surface are well marked. At night the descending air drainage from the tops of the kopjes is often clearly visible. At Bloemfontein the military cantonments are on a kopje, and at sunset the smoke from this source makes it possible to trace a complete system of cold air wending its way

into the basin in which the city lies. The tops of the kopjes are distinctly warmer than the air over the lower ground, and it is therefore more comfortable to bivouac at the higher levels. Mirages and looming are common, the transition between the warmer air above and the colder air below, in the hollows, being often very marked. Dust-whirls are of frequent occurrence during the warmer hours, varying in size from a few inches in diameter to a hundred feet. They move at the rate of about six miles an hour at a maximum, but the speed of rotation is often fifty to sixty miles an hour. Cumulus clouds are a characteristic feature of summer afternoons. When atmospheric instability becomes very marked, violent afternoon squalls of dust, thunder, lightning, rain, and even hail, occur.—(*Symons's Met. Mag.*, Oct., 1906.) R. DEC. W.

AMERICA.

MAGNETIC WORK IN CANADA.—Dr. L. A. Bauer, assisted by Messrs. P. H. Dike and E. H. Bowen of the Department of Terrestrial Magnetism of the Carnegie Institution of Washington, determined during September and October the three magnetic elements (declination, dip, and intensity) at 70 stations in the portion of Canada bounded by the parallels of latitude 42° and 49° and the meridians of longitude 65° and 105° West. In this region very few observations had previously been made. With the completion of this work it is now possible to extend the magnetic maps for the United States up to the forty-ninth parallel across the entire continent. The standard magnetic instruments of the Toronto Magnetic Observatory were likewise compared with those at the Cheltenham Magnetic Observatory, making it possible thereby to reduce all of the magnetic work in the United States and Canada to the same standard. Through the courtesy of Professor Stupart, Director of the Canadian Meteorological Service, the Toronto Magnetic Observatory situated at Agincourt was made available as the base station for the work undertaken by the Carnegie Institution.

THE MAGNETIC SURVEY OF THE PACIFIC.—Dr. Bauer informs the Society that the Magnetic Survey Yacht *Galilee* of the Carnegie Institution of Washington returned to San Diego, Cal., on Oct. 20, having successfully concluded, under the command of Mr. W. J. Peters since March 2d, a cruise of 20,000 miles, embracing San Diego, Fanning Island, Samoan Islands, Fiji Islands, Marshall Islands, Guam, Yokohama, and return to San Diego. Mr. Peters's assistants were Messrs. J. P. Ault and J. C. Pearson, Magnetic Observers, and Dr. H. E. Martyn, Surgeon and Recorder. The sailing master, as in the cruise of 1905, was Captain J. T. Hayes. The two cruises of 1905 and 1906 of this vessel have already furnished sufficient data for the revision of the present magnetic charts of the North Pacific Ocean.

It was expected to despatch the vessel soon on a cruise to Valparaiso, Rio de Janeiro, Washington, D. C., and thence to the Pacific Ocean by way of the Cape of Good Hope and the Philippines in order to obtain some results as soon as possible in the other oceans. It was finally decided, however, that it would not be advisable to undertake the circumnavigation cruise in the present vessel. The work will, therefore, be confined at present to the practical completion of the magnetic survey of the North Pacific, as far as that can be done in a sailing vessel. The *Galilee* will start out in December from San Diego and proceed to the Marquesas Islands, and thence to Tahiti, Apia, Yap, Shanghai, Hongkong, Yokohama, Honolulu, Dutch Harbor, Sitka, and back to San Diego.

The remaining work in the North Pacific is in regions near islands and coasts where a vessel with auxiliary power will be needed. The Survey now urgently needs a specially-constructed non-magnetic, auxiliary-powered wooden sailing vessel to carry on the oceanic magnetic surveys in conformity with all the scientific requirements involved and with due regard to the safety and comfort of the observing party. Preliminary plans and specifications for such a vessel have been drawn up, and it is found that she will cost about $75,000. The Survey should be equipped with the most approved appliances known to science. Instruments and methods have reached the highest stage of perfection, but it now remains to supply a vessel which will not necessitate the determination of deviation corrections. "Swinging ship" at sea is more or less troublesome, especially under sail. The cruises of the *Galilee* have proved that observations on the course may be taken with all necessary scientific accuracy, provided the observers are certain of the deviation corrections on the particular course traversed. These corrections depend, not alone upon certain mathematical laws, but also upon accidental factors which cannot be adequately considered in mathematical formulæ.

Changes along New Jersey Coast.—Under the above title, Mr. Lewis M. Haupt has prepared a most interesting paper, published in the Annual Report of the State Geologist of New Jersey for 1905. He points out that this coast is one of the most dangerous in the United States, and one in which there is no harbour of refuge, in spite of the urgent demand for one, which has frequently been pressed. Between Sandy Hook and Delaware breakwater, a distance of 134 miles, there are believed to be more disasters to ships than on any other stretch of coast-line of equal length in the country. Within the twenty-three-mile range of the lighthouse at Atlantic City 170 casualties were reported in ten years, as compared with 83 within range of the light at Fire Island, and 25 in the dreaded Cape Hatteras region.

The New Jersey coast has importance, also, from an entirely different standpoint. It has come to be one of the most important coast resorts in the country. In fact, in some sections the value of property has increased many thousandfold as a result of this development. In Atlantic City, for example, in twenty-six years the resident population has increased from 6,000 to nearly 40,000, while the transient population exceeds 200,000.

Both the industry of shipping and the entertainment of summer guests are influenced by the marked changes in progress along this coast. These changes are of several kinds. In the first place, inlets are rapidly closing, and harbours which were accessible to coasters within the memory of men now living near them are being closed by a drift of sediment. In the second place, there are numerous instances of the cutting away of beaches and the destruction of valuable property by the attack of the waves. In the third place, the bar-like beaches are being extended by the drift of sediment along the coast before the prevailing waves, and eaten away on the ends exposed to these waves.

For example, the spit which forms the northern boundary of the entrance to Little Egg Harbor has moved southward at the average annual rate of 168 feet between 1769 and 1885, and since 1885 at the rate of about 200 feet a year. Changes at this point are illustrated by the resort known as Sea Haven, which is now laid out across what was formerly a navigable channel. While the spits are being built southward across inlets, the opposite sides of the inlets are being worn away by the wave attack and tide scour. At Hereford Inlet, a few years

ago, the Hotel Royal stood on what is now an extensive mud flat, covering an area of one square mile, and exposed only at low water. This hotel has been moved back three times to escape destruction from the rapid encroachment of the inlet.

Haupt gives many instances similar to this along the New Jersey coast, some of them illustrated by photographs and maps, on which successive changes are marked. It is an important article to the student of geography, and deals with a subject of great interest to the nation. One of the chief points of his paper is to consider the question of what is to be done to stop these changes, and in this discussion he points out the fact that many of the efforts that have been made are of little avail. Is it impossible to abstract his discussion of this subject, but his general conclusion is "that there is urgent need for remedial legislation looking to the opening of the harbours, the reclamation of the beaches and extension of the seaside resorts, the increase in the accessibility of all parts of the shore and its adjacent waters, the establishment of permanent land-marks along the coast, the encouraging and restoration of the fishing, ship-building, and manufacturing interests along the seaboard, and the utilization of the tidal power and reclamation of the tide flats as a source of wealth." R. S. T.

THE DEVELOPMENT OF SANDY HOOK.—In the same article Mr. Haupt notes the changes in the Sandy Hook region. This hook is a region of deposit of sediment supplied by wave attack upon the highlands to the south and drifted northward before the waves and tidal currents. According to the maps of the Ratzer surveys of 1769, the Navesink Highlands, which attain an elevation of 240 feet above sea-level, were at that time open to the full force of the Atlantic waves. The fact that salt marshes are absent north of Navesink River, which then apparently entered the ocean directly, is further indication of the recency of the deposit which now protects these bluffs from the ocean waves. It is believed, therefore, that since 1769 the drift of sediment from the bluffs to the southward has gradually overlapped the face of the Navesink Highland cliffs, closing the mouths of the Shrewsbury and Navesink Rivers, as is at present the case. The present supply for the continued growth of Sandy Hook is now derived from the bluffs between Monmouth and Bay Head, and here the coast-line is rapidly receding.

It is a well-known fact that the persistent and continued growth of Sandy Hook, particularly of its submerged portion, is a constant menace to ships entering New York Harbor; and large sums of money have been expended by the United States Government in deepening and maintaining this channel. Since the cause for this condition is the supply of shore drift derived by wave attack from the cliffs to the south, it is evident "that the arrest of this shore drift would manifestly aid in the securing and maintenance of deeper channels at that important highway of commerce." R. S. T.

RAINFALL IN THE GREAT LAKE REGION.—Professor M. S. W. Jefferson, of the State Normal School, Ypsilanti, Mich., has constructed a map of the rainfall in the region about the Great Lakes, in preparing which the rainfall data for shorter periods are reduced to long series, in the way which has long been recognized abroad as essential if accuracy is desired, but which, thus far, has received practically no attention whatever in the United States. The period for reduction is 1880-1904; 143 stations were used. Of these stations, 48 have records for from five to nine years only. A rainfall chart, in constructing which the data

were employed without regard to the length of the period of observation, is given for purpose of comparison, and it is somewhat surprising to see that the changes resulting from the reductions to a uniform period are comparatively very slight. Some study of the relation of the Lake rainfall to topography is made, and there is a general, though brief, discussion of the distribution of rainfall. For purposes of comparison, a chart is given in which incomplete rainfall records are reduced with reference to the means of six groups of selected stations; another, published by the Weather Bureau in 1902, in which some reduction of short series to long series was attempted, and another, prepared by C. A. Schneider, originally published in 1900. The author is quite right when he claims that his new rainfall chart is an advance on its predecessors.

R. DEC. W.

CLIMATE OF CANADA.—At the recent York meeting of the British Association, Professor L. W. Lyde read a paper on the "Climate of the Wheat Area of Central Canada," showing how the climatic conditions favour the growth of the crop, especially along a line through Brandon and Battleford. A high estimate of the probable output of wheat from this area in the immediate future was given, but the opinion is expressed that wheat-growing here is eminently the work of the small farmer. So far as wheat cultivation is concerned, spring is limited to the four weeks in April. With a unit of population (one family of five persons, at least two being males) the maximum of plough, harrow, and drill that can be "risked" is 80 acres in the four weeks. In summer, which is the rainy season, the duration of sunlight varies from about 15½ hours a day at midsummer in the Winnipeg district to over 17 hours at Prince Albert. The length and intensity of the cold winter do not affect the northern limit of wheat in summer.

R. DEC. W.

GEOGRAPHIC INFLUENCE IN AMERICAN TRADE.—Commercial America in 1905, a publication of the Bureau of Statistics of the Department of Commerce and Labor, while purposing to show the Commerce, Production, Transportation, Finance, Area and Population" of the American countries, makes apparent some of the reasons for the present deplored conditions of our trade with the other American states.

Proximity and physical freedom of intercourse are shown to be two strong factors, as follows: Imports of all North America other than the United States are $531,000,000, of which 54.7 per cent. came from the United States; imports of all South America are $474,000,000, of which only 13.5 per cent. came from the United States. Exports of all North America except United States are $537,000,000, of which 53.9 per cent. goes to the United States; exports of all South America are $702,000,000, and only 20.2 per cent. goes to the United States.

When proximity is made to include physical freedom for intercourse these figures show an interesting agreement between distance from the United States and the relative value of commerce with the United States. As we analyze still more closely, the commerce of seven selected countries in 1904 sets forth a similar ratio between trade and distance. Imports from the United States amounted to: 59 per cent. of Canada's imports; 56 per cent. of Mexico's; 43 per cent. of Central America's; 34 per cent. of Colombia's; 11 per cent. of Brazil's; 13 per cent. of Argentina's; 12 per cent. of Chile's. The relative approachableness of Brazil to New York and Liverpool is also suggested in the fifth item.

Other geographic reasons for our relatively small trade with South America are found in the following facts:

(1) The population of South America is sparse, the total, according to Supan (1904), being 38,482,000.

(2) It is at present still essentially an agricultural country, while our heaviest exports are agricultural (over 55 per cent. of all our exports in 1905 were of this class).

(3) Owing to climatic differences existing between the various South American countries, about 30 per cent. of their imports come from their near neighbours.

(4) The people of European countries, whose dense population makes them more essentially manufacturing than we, succeed in placing their manufactures in South American markets, to our exclusion.

(5) Products of Europe, South America, and the United States, by virtue of climatic and industrial conditions, are such that three-cornered trade is common—*i. e.*, vessels from South America to the United States load with rubber, coffee, hides, and wool, which they exchange with us for grain and provisions, and then sail to Europe, where they exchange our products for manufactures, and return to South America. This is further encouraged by the fact that we send more to Europe than we buy from her.

(6) A study of the map of the Atlantic, especially on a globe, will reveal the fact that some of the South American ports are nearer to European centres than they are to our own, and that most of them are at least as convenient to European countries as to us.

Another handicap to our South American trade, though not geographic in itself, has in part grown out of geographic conditions. Most of the vessels carrying goods to South American ports are controlled by European capital.

The above-mentioned report further mentions the lack of banking and business facilities between the United States and South American states, and the neglect of our merchants and manufacturers to study and heed trade methods and requirements of the South American market.

One conclusion reached is that improvements which shorten the distance between us and our South American neighbours make for increased commerce. Thus the author sees improved trade with the opening of the Isthmian Canal and the completion of the Trans-Andean railroad from Argentina to Chile. With these and a larger number of American vessels to both Atlantic and Pacific ports we may expect a more gratifying commercial intercourse.

The report is completed with many tables of statistics analysing the industries and trade of each country. G. D. H.

ASIA.

The Pilgrim Railroad to Mecca.—The building of the Pilgrim Railroad which is to connect Damascus with Medina and Mecca, the holy cities of Islam, has not attracted much attention in the Occident. Auler Pasha, a German military officer, now a general in the Turkish army, who has had the best opportunities for studying this great project, has filled this important gap in our knowledge of great railroad enterprises by writing an exhaustive paper, with a good map, which appears as *Ergänzungsheft* No. 154 of *Petermanns Mitteilungen.*

The *Irade* of the Sultan of Turkey calling upon Mohammedans in every land

to supply the means for building the road was issued in July, 1900. The contributions have been large and continuous and are supplying nearly all the funds. There is no longer any doubt that the project will be completely carried out. The entire length of the line between Damascus and Mecca will be 1,800 kilometers. In 1904, the section Damascus-Mahân (459 km.) was completed. Last year the line was extended to Mudewwere, 572 km. from Damascus. By the end of this year it will be opened to Tebuk, 670 km. In other words, by the end of this year over one-third of the line between Damascus and Mecca will be in operation.

Every Moslem who can afford the expense expects to make the pilgrimage to Mecca at least once in his life. Most of the pilgrims, averaging about 100,000 a year, reach the Holy City by the sea route to Jiddah and the caravan road from that Red Sea port to Mecca. Only about 10,000 pilgrims, chiefly Syrians, take the long and difficult desert route from Damascus. It is to enable numerous pilgrims from European Turkey, Asia Minor, Persia, and north Africa to make the journey more expeditiously, comfortably, and cheaply that the Pilgrim Railroad was projected. It is intended that the pilgrimage shall be placed within the reach even of many poor Mohammedans.

But, in addition to the religious purpose to be served, the railroad will undoubtedly be of great strategical importance at the Turkish Government. The nomads of the Arabian desert will be within reach of Turkey's military arm, and pilgrims will be safeguarded against their attacks. During the rebellion in Yemen in 1905 the Sultan sent battalions of infantry southward over the completed part of the road to within four days' march of the Gulf of Akaba, Red Sea, where steamers awaited them, and the troops reached Yemen, it is said, in eight days' less time than would have been required by way of the Suez Canal.

At the end of 1905, 46,700,000 francs had been expended in construction works, most of the money being the offerings of the Faithful, a small part, however, being raised by the stamp tax and the revenue from the sulphur and phosphate mining works along the railroad.

All of the technical staff are foreigners, the chief engineer, Meissner Pasha, being German. Austrians and Italians, as well as Germans, are prominent in the more responsible positions. Most of the railroad material, such as rails, ties, and rolling stock, is imported. All the artisans and common labourers are Turkish soldiers detailed for the work, and 5,700 of them are now engaged in it. They receive a small advance on their regular pay, and their religious zeal helps them to endure with fortitude the unusual discomforts of hard labour in a desert glowing with heat.

The line has been built southward from Damascus parallel with the Jordan Valley and 50 to 60 kilometers from it, following chiefly the old pilgrim road through the basin of Hauran and the east Jordan lands to the Arabian desert, through which it is now being extended towards Medina. The cost of transporting all the railroad material over the French railroad from Beirut to Damascus and southward steadily increased as the road progressed. It was, therefore, decided to build a branch from the port of Haifa to the Pilgrim Railroad, at Dera. This branch, 161 kilometers long, was opened to business on Sept. 1, 1903. Being a part of the Pilgrim Road, the branch not only cheapens the transportation of building material, but is expected, also, to serve in future as a short cut by which many thousands of pilgrims from the Mediterranean will reach the main railroad.

The main line is being extended almost entirely over a waterless and desert highland, where no vegetation grows and very few people live. For hundreds of miles there is not a single permanent human settlement within 50 to 100 kilometers of the track. There are a few small oases in the waste, but the entire country from Damascus to Medina is occupied only by small bands of Bedouin nomads and their flocks. Between Damascus and Mudewwere 1,532 bridges, aqueducts, cuttings, and other artificial works have been required. The greatest difficulty is the scarcity of water. It is derived from a few scattering cisterns and wells; and to the south the embarrassment is intensified. Efforts are being made to relieve the situation by sinking new wells, some of them artesian. All the water now used for drinking and cooking purposes and for preparing mortar is carried to the railhead in water-cars. This adds much to the cost of the enterprise.

The country supplies no wood, coal, or petroleum, but all fuel must be imported. Fortunately, the climate is so warm that little fuel will be required excepting for the locomotives and machine shops. Plenty of stone is found *in situ* for constructing the station buildings, bridges, etc. The rolling stock, imported from Germany and Belgium, includes at present 43 locomotives, 522 freight, and 31 passenger cars and 15 water-cars. Three round trips are made each week between Damascus and Mudewwere, and during the height of the pilgrim season five passenger trains leave Damascus daily for the railhead, where caravans of camels are kept in readiness to carry the pilgrims on their way. The average speed of passenger trains as yet is only twenty-three kilometers an hour. It is expected that the present rate of construction will be maintained until the road is completed. If this hope is realized trains will be running to Mecca in 1915.

The French Lebanon Company has completed its railroad from Damascus northward to Hama, and will soon be able to run trains still farther north to Aleppo. It is expected that before the Pilgrim Railroad is completed the German line through Asia Minor will be finished to Bagdad and the Persian Gulf. The French line need be extended only a short distance northward from Aleppo to join the German line. Mecca will then have 3,700 kilometers of continuous rail connections, extending from Constantinople (Skutari) across Asia Minor to the Persian Gulf. The Pilgrim Railroad will be thronged with devotees from European Turkey, Asia Minor, and Persia, who will make the journey to the holy cities practically all the way by rail.

Changes of Climate in Asia Minor.—Evidence of changes of climate within historic times has often been based on the fact that where now we find small populations and abandoned wells or irrigation works, there were formerly more inhabitants, extended irrigation, and abundant vegetation. These supposed changes of climate are, however, often easy to explain on the ground of a change in the habits of the people, in their government, or in their numbers. In his address on *Past and Present in Asia Minor,* delivered before the York meeting of the British Association, Professor Ramsay brought out this very point. The conquest of Asia Minor by the Turks meant the reduction of a great part of the country from a settled and civilized state to a semi-nomadic condition. The industries of the Roman Empire gradually died out in large measure, some surviving until now and some having disappeared within the memory of living men. The land to a great extent passed out of cultivation; irrigation works were destroyed or fell to pieces; the land became stony; terraces were destroyed. The only cure

is to be sought in generations of peasant proprietors. The olive almost ceased to be cultivated, not, it should be noted, because of change of climate, but because of change in the habits of the people. Recently there has come a revival of prosperity. Communication by roads and railways is being restored. Industries are reviving; an industrial population is spreading along the railways. Agriculture is being developed; cotton is being grown; the waste land around Smyrna is being reclaimed because *bona-fide* cultivators are securing allotments of land. The whole picture furnishes an excellent illustration of how man, if he be so disposed, can largely master climatic handicaps. A change in man, not of climate, has been taking place in Asia Minor. R. DEC. W.

EUROPE.

THE TROUGH OF THE RHINE WHERE IT ENTERS LAKE CONSTANCE.—In Col. J. J. Lochmann's paper "De la Cartographie en Suisse" (*Le Globe,* Geneva, Tome 45, 1906) he gives some details concerning the trough, revealed by soundings, which the Rhine has made at its entrance into the lake. This deep and narrow trench is bordered by embankments, composed of sand and alluvial material. M. Forel advanced the following explanation:

The water which the Rhine pours into Lake Constance is much colder than that of the lake, and therefore sinks to the bottom and continues its course with a part of the velocity it had attained. Thus it deepens its channel on the lake floor; furthermore, being heavily charged with alluvium, it deposits this material to the right and left of its course. It has thus both excavated the lake floor and raised embankments on either side above the general level of the lake bottom. The trough and accompanying embankment do not follow a straight line, but form capricious meanders as far as Arbon, about six miles from the Rhine's entrance into the lake. There the trough widens, but is less deep, and finally disappears.

Other affluents of the lake do not produce the same effects, probably because their waters are not so cold and are inferior in volume and do not carry so much alluvium.

This discovery, made in 1885, raised the question whether similar phenomena would be found in Lake Geneva where it receives the Rhône. Investigation shows that the same condition of things exists on the floor of that lake. The sub-lacustrine ravine is, however, a little longer than in Lake Constance, and has a straighter course. None of the other affluents of Lake Geneva shows the same phenomena.

FORESTS AND RAINFALL.—The ever-recurring problem concerning the influence of forests upon the amount of rainfall is gradually being solved in the only possible satisfactory way—namely, by careful studies of the influence of different exposures of the rain-gauge, of wind, and of snowfall upon the resulting catch. Dr. J. Schubert, of the Meteorological Division of the Forest Experiment Station of Prussia, is giving this matter careful attention, and his conclusions are certain to be of very great service in throwing light on this very obscure question. Hitherto, hasty generalizations, based on incomplete and inaccurate data, have been widely quoted and have found general acceptance. The observations recently carried out were made in western Prussia and Posen. They showed at first a probable excess of 2.3% at a station in an opening within the forest in western Prussia, and of 0.8% at a similar station in Posen as compared with

stations outside the forest, the distance from the forest being 1 km. in both cases. The general result is similar to that previously obtained in Silesia, in showing a larger measured rainfall at forest stations than in the open, the excess *averaging* at a maximum between 1 and 2%, the distance of the forest being 1 km. in all cases. This value, however, is an outside limit of the forest influence, for no account is here taken of the effect of wind on the rainfall catch. Careful observations show that the effect of wind in a forest opening is an important factor in giving somewhat larger precipitation there than in the open. All rainfall data from forest stations which are not corrected for wind effects are misleading, in that they exaggerate the forest influence. It is also clear that the amount of snowfall caught in the gauge is much affected by wind, and that the error of an unprotected gauge increases with the number of days with snow. Hence a forest gauge will show more precipitation the more snowfall there is. Dr. Schubert comes to the conclusion that, when the influence of the wind is taken into account, his forest station does not show more precipitation than the open. R. DEC. W.

THE NINTH INTERNATIONAL GEOGRAPHICAL CONGRESS: CIRCULAR OF INVITATION, PRELIMINARY INFORMATION AND PROGRAMME.—The Congress will be held at Geneva from the 27th of July to the 6th of August, 1908. Membership may be acquired by payment of 25 francs (=20 marks=1 pound sterling=five dollars) to M. Paul Bonna, Treasurer of the Committee on Organization, 3 Boulevard du Théâtre, Geneva. An additional payment of 12.50 francs will secure a card of admittance for a lady or a person under twenty years of age. These will enjoy all the privileges of members except the rights of voting and of receiving the publications. Payment must, in every case, be made in advance.

The sessions of the Congress will be of two kinds: the General Sessions, of which there will be at least eight, and the Sessions of the Sections.

The Sections will be constituted as follows (subject to modification by the Committee on Organization):

Mathematical Geography and Cartography;
Physical Geography in General;
Vulcanology and Seismology;
Glaciers;
Hydrography (Potamography and Limnology):
Oceanography;
Meteorology and Climatology;—Terrestrial Magnetism;
Biological Geography (Botanical Geography and Zoogeography);
Anthropology and Ethnography;
Explorations;
Economical and Social Geography;
Teaching of Geography;
Historical Geography.

Every communication or paper intended for the Congress must be accompanied by a résumé clearly written, or typewritten, on one side of the leaf, and not more than 300 words in length, to be sent in as soon as possible and at the very latest by November 30, 1907, to the Committee on Organization. By this Committee the résumé will be referred to the proper scientific Commission for examination and the Executive Commission will report to the author, without delay, the decision made. The national tongues of Switzerland—German, French and Italian—and the English language are the recognized languages of the Congress. Communications, oral or written, may be made in any one of these four languages, and memoirs may be submitted also in Latin. The length of communications, whether read or spoken, is limited to fifteen minutes or, by

special exception, to twenty minutes. This limitation applies also to discussions. The members of the Congress will understand the necessity of complying with this arrangement and the presiding officers will see that it is strictly observed, since upon this will depend the carrying out of the programme, the orderly conduct and the success of the Congress.

This regulation relates only to the sessions of the Sections. In fixing the order of the day for the General Sessions the Executive Commission will determine the time to be allotted to each object.

The Committee on Organization will establish, in 1907, the definitive rules and programme of the Congress and of the Sections, so that they may be brought to the knowledge of all who are interested by the month of January, 1908.

This Committee will be charged with the management of the Congress when assembled and with the carrying out of the programme.

After the Congress, the Committee on Organization will publish the Compte Rendu (reports, memoirs, resolutions, &c.), if it can be done in 1909, and in any case before the close of the year 1910. The Compte Rendu will be sent *free* to each member of the Congress.

The Honorary Presidents of the Congress are:

The President of the Swiss Confederation;

The President of the Council of State of the Republic and Canton of Geneva;

H. M. Leopold II., King of the Belgians, Sovereign of the Congo Free State;

H. M. Charles I., King of Rumania.

The President is M. Arthur de Claparède, the President of the Geographical Society of Geneva.

The long list of the Honorary Vice-Presidents is headed by the four surviving presidents of the preceding International Congresses:

The Duke di Sermoneta, Prince of Teano (Congress of Venice, 1881);

Dr. Albert Gobat, Councillor of State and National Councillor (Congress of Berne, 1891);

Sir Clements R. Markham (Congress of London, 1895);

Commander Robert E. Peary, U. S. N. (Congress of 1904, in the United States).

PERIODICITY IN THE TEMPERATURE OF STOCKHOLM.—Woeikof has investigated the temperatures at Stockholm for the 150 years 1757 to 1906, inclusive (*Met. Zeitschr,* Oct., 1906), without prejudice in favour of any definite periodicity, such as that of the sunspots, or the Brückner 35-year cycle. It appears that Stockholm has a very warm winter in every eighth year, January being the most concerned in this departure and February the least, of the winter months. As, especially in winter, similar departures from the mean extend over large areas, this phenomenon is probably to be found over much of Europe. Woeikof has already shown that it holds in St. Petersburg. Woeikof is not inclined to look for any cosmic influence in this eight-year period, but seeks the cause in a shift in the location of the areas of high and low pressure, which results in giving cold winters in the south, and especially in the southeast, of Europe when the winters are warm in the north. R. DEC. W.

MARSEILLES GEOGRAPHICAL SOCIETY.—The Geographical Society of Marseilles is thirty years of age this year. The first number of the thirtieth volume of its *Bulletin* celebrates the occasion by publishing the history of the Society, a list of its members, and an excellent index to the volumes of the *Bulletin,* which

will be welcomed in geographical circles generally as a useful bibliography. Among the illustrations are pictures of some of the past and present officers of the Society, and views of the Committee-room and library.

POLAR.

CAPTAIN AMUNDSEN RETURNS TO EUROPE.—Captain Roald Amundsen, his first officer, Lieut. Hansen, and the crew of the *Gjöa* arrived in New York on Nov. 6, having left their vessel at San Francisco. A short stop was made in Chicago, where, on the evening of Nov. 3, the Geographical Society of Chicago gave a banquet at the Union League Club in honour of Captain Amundsen's three and a half years of successful exploration in the region of the magnetic north pole, and the making of the Northwest Passage. Addresses were made by Captain Amundsen, Lieut. Hansen, Professor Henry J. Cox, President of the Geographical Society of Chicago; the Norwegian Consul, Frederick H. Gade, and by Professors R. D. Salisbury and T. C. Chamberlin of the University of Chicago.

On the evening of Nov. 7 the party were entertained at the rooms of the Germania Club, Brooklyn, at a dinner given in their honour by the members of the Norwegian Club of New York. Mr. Anton A. Raven, Recording Secretary of the American Geographical Society, represented the Society at the dinner. A letter was read from President Roosevelt congratulating Capain Amundsen on his Arctic work. Capt. Amundsen made a brief speech on the work of the expedition. Nov. 8, he sailed for Norway.

CANADIANS WINTERING IN THE ARCTIC.—The Canadian Government steamer *Arctic* sailed from Quebec last summer for northern latitudes *via* Greenland. She will winter in Lancaster Sound.

VARIOUS.

FURTHER EXPLORATIONS IN THE UPPER AIR.—*Science* says that the third cruise of the *Otaria,* the steamer yacht sent by M. Teisserenc de Bort, director of the private meteorological observatory at Trappes. near Paris, and by Mr. Rotch, director of the similar observatory at Blue Hill, near Boston, to explore the atmosphere over the tropical Atlantic, has ended, and the yacht has returned to Havre after a very successful voyage of three months and a half.

Atmospheric soundings with balloons and kites were executed over the central part of the North Atlantic, the equatorial regions, and the South Atlantic as far as Ascension Island. The soundings southwest and northwest of the Canaries confirm the conclusions reached during the two preceding cruises of the *Otaria* —namely, that the upper anti-trade blows from the southeast or southwest, not only within the tropics, but generally as far north as latitude 30°, and is found above the open ocean as well as above the Canaries. Farther north it is transformed into a westerly wind.

The observations with *ballons-sondes* revealed this new and important fact, that in summer over the equator very low temperatures (reaching — 80° C.) exist in the upper air above 12 kilometers, being analogous to those occurring in winter at the same height in our own latitude.

TROPICAL RAINS.—After a close study of tropical rains, extending over many years, and especially of the rainfall of Java, Woeikof comes to the conclusions here enumerated (*Met. Zeitschr.*, October, 1906):

1. The intensity of tropical rains is, on the average, greater than the intensity in middle latitudes.

2. The difference is not very great.

3. The heaviest sudden downpours have thus far been observed in middle latitudes.

4. General, light rains of considerable duration are known in many parts of the tropics, and even have special names. Such rains have long been known for the west coasts of South America and Africa, but in the foregoing statement other tropical districts are referred to.

5. The heaviest daily rainfalls have been observed outside the tropics, thus in Cherrapunji, Assam, 40.94 inches; Tanabe, in Japan, 35.51 inches, and at two other stations in northern India over 30 inches.

6. It is probable that the heaviest rains in the tropics fall during large cyclones.

7. A larger number of self-recording rain-gauges, and detailed discussion of the results, especially in cases of the heaviest rains, are very much to be desired.

8. It would be especially interesting to know whether in the tropics, as in the higher latitudes, the larger rainfall amounts on the windward sides of mountains do not depend on the longer duration of the rain, rather than on their greater intensity. R. DEC. W.

ISLANDERS OF TRISTAN DA CUNHA.—A Blue-Book, issued by the British Colonial Office, says that in view of the poverty of the islanders of Tristan da Cunha, correspondence was opened with the Ministry of Cape Colony concerning the deportation of the islanders to that colony. The Cape Ministry replied that it was prepared to share the cost and would send a representative to the island to lay the proposal before the inhabitants. Mr. Hammond Tooke was accordingly sent there; but as the majority of the islanders decided to remain, the Cape Government took no further steps. Most of the Blue-Book consists of an exhaustive report by Mr. Tooke on the islanders, including recommendations for the ameliorization of their condition. He proposed that a chaplain and schoolmaster should be appointed at an early date. The islanders numbered 15 males, 24 females, and 43 children. They are unable to contribute £75 for the salary of a schoolmaster, as was suggested by the Cape Government. In April last a clergyman and his wife went to the island for the purpose of ministering to the needs of the inhabitants.

NEW MAPS.

AFRICA.

EAST AFRICA PROTECTORATE.—Map to illustrate the "Masai, their Language, and Folklore." Scale, 42 miles to an inch. The Oxford Geographical Institution, 1905.

The map illustrates a book by Mr. A. C. Hollis with the above title. It shows the distribution of this tribe before they were collected on reservations. Masai names are written in red, and the territory occupied by the tribe, both in British and German East Africa, is tinted brown.

AFRICA.—Raised Map of Africa—(1) Physical Features, (2) Political Divisions with Guide. Weekly Summary, Eltham, Kent, England, 1906. (Price, 1s. 9d.)

The map is intended for the blind. Two sheets are modelled, one giving

the principal physical features of the continent, and the other the chief political divisions. On the physical sheet is an indication of the points of the compass. The scale of the map is 100 miles to three-sixteenths of an inch. Meridians of longitude are indicated at the top and bottom by straight strokes. Parallels of latitude are indicated by threads carried across the map, the Equator being shown by a thicker thread. The sheets are accompanied by text in Braille giving a large number of facts relating to the continent, some of which are not as accurate as might be wished. Lake Lanji, for example, is mentioned as one of the lakes through which the upper Congo flows; but it was proved, years ago, that this lake does not exist. On the political map all the physical features are omitted, excepting the Nile River and the larger lakes. The boundaries of the various states and colonies are shown by raised lines, and the principal towns are indicated by dots.

AMERICA.

U. S. Hydrographic Office Charts.

Pilot Chart of the North Atlantic Ocean, November, 1906.

North America.—Carte Géologique de l'Amérique du Nord. Scale, 15,000,000, or 78.9 statute miles to an inch. By Henry Gannett, Geographer, and Bailey Willis, Geologist. U. S. Geological Survey, Washington, D. C., 1906.

This large geological map of North America, including Greenland, was the joint work of the geological surveys of Canada, the United States, and Mexico. A copy of the map was presented to each member of the Tenth International Geological Congress at Mexico City in September last. Twenty-five tints are used to show geological formations, and the meaning of the colours is explained in French and Spanish letterpress. An explanation of the map, written by Mrs. F. B. Adams, was distributed among the members. The map is to undergo further revision, and will eventually appear, it is said, as one of the *Professional Papers* of the U. S. Geological Survey. The colours are printed with delicacy, the registration is perfect, the present geological knowledge of the continent is perhaps set forth as fully as can be done on a map of this scale, and the product is certain to be very useful.

Canada.—Map of the Dominion of Canada showing Progress of Field Operations by the Geological Survey, 1843-1903. Scale, 250 statute miles to an inch. *Annual Report* Geological Survey of Canada, Vol. 25, 1902-3, Ottawa, 1906.

This small-scale map illustrates a summary report by Dr. Robert Bell. It gives an idea of the vast amount of good topographical work performed by the Survey during the past sixty years. Most of the occupied area in the south has been geologically surveyed and partly mapped. These regions are coloured dark red, while areas in the settled districts that have been less completely investigated are light red. The routes explored and surveyed in the more northern parts of Canada are also shown in red. These reconnaissance surveys extend through all parts of the country to a distance of about 1,000 miles northward from the international boundary.

Canada.—Map of Part of Northwestern Ontario, North of Lake Superior. Scale, 16 statute miles to an inch. *Annual Report* as above.

One of the canoe routes from Lake Superior to the Albany River flowing into James Bay crosses the Height of Land north of Montizambert on the Canadian

Pacific and follows the Nagagami River to its junction with the Kenogami, and thence to the Albany. Mr. W. J. Wilson made an instrumental survey of this route between Lake Superior and Hudson Bay, and the results are shown on this map.

CANADA.—Map of Part of Northern Ontario and Eastern Keewatin, Southwest of James Bay. Scale, 16 statute miles to an inch. *Annual Report* as above.

Illustrates a summary report by Mr. W. J. Wilson, on his exploration and survey of the regions between the Attawapiskat and Albany Rivers and between the Albany and Moose Rivers, on the west coast of James Bay. These and similar surveys are enlarging our knowledge of the water systems tributary to Hudson Bay.

CANADA.—Sketch Map of Part of Southwestern Ontario showing Shorelines of Ancient Great Lakes. Scale, 24 statute miles to an inch. *Annual Report* as above.

In that region evidences of ancient water-levels above the shores of the present lakes are shown by shore-lines cut into the clays or gravels by terraces formed of stratified deposits and by beaches thrown up by the waves. This is a map of these ancient shore-lines to the north of Lake Ontario and Erie, illustrating a report by Dr. Robert Chalmers.

CANADA.—Map of a Portion of the Yukon Territory showing Explorations on the MacMillan, Pelly, and Stewart Rivers. Scale, 1:506,880, or 8 statute miles to an inch. *Annual Report* as above.

Illustrates a report by Mr. R. G. McConnell. The work consisted chiefly in an examination of the MacMillan River, about 285 miles long, and one of the principal feeders of the Pelly.

CANADA.—Map of Part of the District of Keewatin showing Survey of the Winisk River. Scale, 16 statute miles to an inch. *Annual Report* as above.

Illustrates a report by Mr. William McInnes, who, in 1903, surveyed the Winisk River, about 340 miles in length. In its upper course the river is interrupted by many rapids.

CANADA.—Orographic Map showing Contour of Lower Slope of Turtle Mountain, Manitoba. Scale, 1½ statute miles to an inch. *Annual Report* as above.

This map, illustrating a survey by Mr. D. B. Dowling, is contoured to show intervals of twenty-five feet difference in elevation over the lower slope and 100 feet in the higher parts. The economic importance of this survey relates to beds of coal or lignite.

ASIA.

ASIA.—Stanford's New Orographical Map of Asia. (4 sheets.) Scale, 1:8,721,500, or 137.6 statute miles to an inch. Compiled under the direction of H. J. Mackinder. Edward Stanford, London, 1906. (Price, coloured sheet, 16s.; mounted on rollers and varnished, 20s.)

This map is one of the excellent series of orographical school maps of the continents now being issued by this house. The map, like those which preceded it in this series, was compiled under Mr. Mackinder's direction from original materials, chiefly the Government surveys. Six tints show elevations from sea-level to more than 15,000 feet above the sea, and 7 tints show depths from sea-level to more than 15,000 feet below sea-level. The drawing of the contour

lines at the same intervals above and below sea-level will enable the student easily to compare the great positive and negative features of the regions, such as the high plateau of Tibet and the abysses of the Ocean, east of Japan. We know of no wall map which more graphically depicts the continental land-forms and the varying depths of the bordering oceans than this physical map of Asia. The drainage is in deep blue; and though the primary purpose of the map is to depict the physical features of the continent, the employment of a gray, almost transparent, lettering make it possible to insert many geographical names without blurring the topographical details.

INDIA.—River Hooghly, Calcutta to Saugor. (3 sheets.) Scale, 1:80,724, or 126 statute miles to an inch. From Surveys made by the officers of the River Survey Department under the direction of E. W. Petley, Deputy Conservator of the Port. Calcutta, 1904-05.

Gives the detailed results of the surveys of the Hooghly from Calcutta to the Bay of Bengal. The many hundreds of soundings are in feet, and all heights are expressed in feet and decimals.

AUSTRALASIA.

NEW ZEALAND.—Topographical and Geological Plans of the Mahinapua, Kanieri, Turiwhate, and Browning's Pass Survey Districts. Accompanying the Report on the Hokitika sheet of the North Westland Quadrangle. Scale, 80 chains to an inch. *Bulletin* No. 1 (new series) New Zealand Geological Survey, Wellington, 1906.

These are sheets of the detailed topographical and geological map of New Zealand whose preparation has begun in the survey as reorganized by Dr. J. M. Bell, the new Director. The topographical plans give the effect of relief, and indicate swamps, mountain peaks, edges of bush, etc. The wish may be expressed that future sheets will give elevations above sea-level of many valleys as well as of mountain summits. On the geological plans the relief detail of the topographic plans is omitted, and geological information is indicated by colours and signs. All facts are very clearly expressed, though it is not quite so easy on these sheets to compare geological with topographical details as in our geologic folios.

EUROPE.

ENGLAND.—Bartholomew's Road Surface Map of London and Neighbourhood. Scale, about 2 inches to a mile. John Bartholomew & Co., Edinburgh, 1906. (Price, 2s. 6d.)

The map is mounted on cloth and folded to pocket size. It belongs to the finest class of road maps. Thin, black lines divide it into mile squares and facilitate the estimating of distances without referring to the scale. The area covered extends from Tottenham in the north to Hampton Court in the south and from Abbey Wood in the east to beyond Twickenham in the west. The road-colouring shows whether the highway is wood, asphalt, macadam, or cobble-stone. Tramway routes and recommended approaches and main routes are distinguished from other highways. The scale is so large that the entire street plan and the names of the streets of London are printed clearly. The map fully meets the needs of wheelmen and others who require a road map of London and its immediate suburbs.

HUNGARY.—Specialkarte des Balaton-Sees und Seiner Umgebung. Part I, 4 sheets.) Scale, 1:75,000, or 1.18 statute mile to an inch. Planned by Ludwig von Lóczy. Sheets produced by the Imperial and Royal Military Geographical Institute, Vienna, 1903.

These sheets form a topographical and cultural map of Lake Balaton and its surroundings, produced in the admirable style of this Government map-house. A very large amount of detail is given, such as vineyards, forests, mills driven by steam or water, manufactories, limekilns, railroads distinguished as one and two track roads, and highways of various degrees, from the very best roads to footpaths.

RUMANIA.—Carte de Roumanie. No scale. *Annales des Mines,* Paris, April, 1905.

Illustrates an exhaustive monograph, "L'Exploration du Pétrole en Roumanie," by M. Aron. Shows the geological formations in the petroleum regions of the kingdom, the localities where petroleum is found, and cross sections of some of these districts. The existence of petroleum in Rumania has long been known; but its exploitation began only in 1860, when 3,000 tons of raw oil were produced. The product in 1903 was 384,000 tons, and in 1904, over 400,000 tons, Rumania now holding the fifth place among oil-producing countries, though its share of the total product is only a little over 1 per cent.

ATLASES.

ATLAS OF THE WORLD'S COMMERCE.—Compiled from the latest Official Returns at the Edinburgh Geographical Institute. Edited by J. G. Bartholomew. (Parts 11, 12 and 13). George Newnes, London, and Frederick Warne & Co., New York, 1906. (Price per Part, 25 cents.)

With Part 11, half of the complete issue of this Atlas is now ready. Part 11 contains seven maps showing the distribution of the world's fisheries and the productive areas of maize and oats, rice and rye, the potato and manioc. Statistical diagrams, with accompanying text, give the average production of and trade in fish. A new feature is a review of those regions in which wide areas are still undeveloped and which are capable of adding largely to the supplies of the commodities most in demand. The Dictionary of Commodities is completed in this part.

Part 12 has maps showing the distribution of barley, millet, sago, cocoa, and spices. Nine inset maps give information relating to cocoa and spices on larger scales. Coloured diagrams, with descriptive letterpress, give details as to the production and consumption of these commodities. The first four pages of a monograph entitled "An Introduction to Economic Geography," by Mr. George G. Chisholm, appear, and the paper will be continued in the following numbers. Mr. Chisholm defines the scope of economic geography, shows what is included under the heads of the production, transportation, and exchange of commodities, and how geographical considerations arise with reference to them.

Part 13 includes two world maps, showing the distribution of 16 kinds of precious stones and of the pearl and coral fisheries, and three maps showing the areas of cultivation of flax, hemp, jute, ramie, and other fibres, with the distribution of flax cultivation in Europe on a larger scale and the centres of linen manufacture. The descriptive letterpress and diagrams are devoted to these commodities and to petroleum. Mr. Chisholm's monograph, "An Introduction to Economic Geography," is continued.

BOOK NOTICES.

Katalog der im Jahre 1903 bekannt gewordenen Erdbeben. Im Auftrage der Kaiserlichen Hauptstation für Erdbebenforschung zu Strassburg i. Els. Zusammengestellt und herausgegeben von Prof. Dr. E. Rudolph. Mit 7 Karten. Leipzig: W. Engelmann, 1905.

Even those persons who have some familiarity with the subject of seismology will be surprised to learn that a book of 333 double pages is required merely to catalogue in tabular form the reported earthquakes of a single year that were of sufficient magnitude to be perceptible to human senses. The list is necessarily incomplete, reports from some stations not being prompt enough to be included; but the records of 4,760 quakes are given, and many of the shocks were of importance. New Zealand is not represented, and evidently too few shocks have been reported from South America. The data published in the volume are arranged in columns giving the place, date, time, kind of shock, intensity, duration in seconds, direction of movement, accompanying phenomena, area of disturbance, time (mean Greenwich) and place of registration by seismograph, remarks upon the character and effects of the shock, and, finally, the source of information. The quakes are arranged chronologically.

The care with which the catalogue has been prepared may be inferred from the treatment of the question of the place and time of the occurrence of the shock. The place-names have been verified as to position and spelling. The times are all given as they stand in the original reports, except that afternoon hours have been changed when necessary to conform to the 0 to 24-hour clock-reading. On account of the various time-standards used in different parts of the world, a column has been introduced into the tables which gives the correction to be applied to reduce the reported time to mean Greenwich time, and the entries in the tables are in the order of the corrected times. An interesting feature of the distribution of the earthquakes according to time of occurrence is that 1,782 shocks were reported for the first quarter of the year, 943 for the second quarter, 1,034 for the third quarter, and 1,001 for the fourth quarter.

Seven sketch maps show the area of disturbance of that number of the strongest and most interesting earthquakes. These maps illustrate the zones of intensity, direction of propagation and other features of the earthquakes of Vogtland, 13 February to 18 May; southeastern Alps, 16 February; western Siberia, 12 March; southeastern Austria, 20 March; Eger in Hungary, 26 June; Portugal, 9 August, and lower Danube country, 8 June, 13 September, and 26 November.

The volume attempts no further analysis of the formidable array of statistics that it contains, but such an accurate record is of the highest value to the science of seismology and to the general student of earth phenomena; the more so as it is the first comprehensive or rather world-embracing list to be published. It would not have been feasible without the initiative of the Imperial German central earthquake observatory at Strassburg, and it was undertaken on the suggestion and through the efforts of the director of that observatory, Geheimer Oberregierungsrat Lewald. At the time of the publication of this volume there remained to be published the records of the microseismic disturbances, or those which were too weak to be caught except by instruments of high delicacy and precision. E. O. H.

The Climatology of the United States. By A. J. Henry. United States Department of Agriculture, Weather Bureau, Bulletin Q. 4to. Washington, D. C., 1906. pp. 1012. Pls. 34. Figs. 7.

The situation regarding the publication of climatological data for the United States has been very unsatisfactory. Meteorologists abroad have frequently, in private conversation and correspondence, as well as in print, found fault with the Weather Bureau—and justly, too—for not publishing, in one volume, in fairly complete form, such data as are universally regarded as essential to an adequate understanding of our climate. To be sure, the Annual Reports of the Chief of the Weather Bureau contain, from year to year, summaries of the ordinary meteorological records for the year, and usually also some tabulations for longer periods of different important climatological data not otherwise accessible. But since Blodget's famous classic, "The Climatology of the United States," published in 1857, there has been no attempt to collect, in one volume, with adequate discussion, complete summaries for the different meteorological stations scattered over the United States. Teachers and students who have sought anything like a fairly complete presentation of the climatology of the United States have been forced to search through many volumes of the Reports of the Chief of the Weather Bureau, Weather Bureau Bulletins, publications of the various State sections of the climate and crop service of the Weather Bureau, and the like—in short, the task has been burdensome, time-consuming, and highly unsatisfactory.

At the Washington meeting of the International Geographic Congress, held in September, 1904, Professor A. J. Henry presented a paper on "A Climatological Dictionary of the United States," in which he announced the forthcoming publication of a report, such as that which has so long been needed. The announcement was welcomed in Europe, and for the past year many workers in meteorology in various parts of the world have been waiting for the appearance of the volume, the proof-sheets of which—through the courtesy of Professor Henry—are before us. We may say that we accord this publication a very hearty welcome, because of the great help it will be to all teachers of geography; because it will spread sound information among our own people concerning the climatology of their own country, but chiefly because it will tend to silence some of the well-deserved criticisms which have been so often heard regarding our inexcusable inactivity in presenting, in compact form, and according to recognized standards, the results of the many years of observations which are in the possession of the Weather Bureau. As the Chief of the Bureau rightly says in the Preface to this Bulletin: "While climatological observations have been steadily accumulating for the last quarter of a century, the general results are inaccessible, not only to the general public, but also to the majority of students and investigators interested in the advancement of scientific agriculture in the United States. The work herewith aims to present in form for ready reference comparative climatic statistics for the different portions of the United States, accompanied by explanatory charts and text."

The data in this volume cover, generally speaking, the period 1870–1903, and include those collected primarily for weather-map purposes, and also those obtained by the voluntary observers for purely climatic purposes. In the first part of the book we find a discussion, somewhat too brief to be altogether satisfactory, of the general controls of the *climates* (we prefer the word in the plural when applied to so large an area) of the United States; and here we are especially pleased to note the attention paid to cyclonic and anticyclonic control of climate, the classes of cyclones and anticyclones, their tracks, and their control of weather changes. Many illus-

trative maps accompany this discussion. In a paper read before the Eighth International Geographic Congress, entitled "Suggestions concerning a more Rational Treatment of Climatology," the reviewer pointed out the need of emphasis on the cyclonic and anticyclonic units in presenting climatological data, and gave a series of curves to show how the tracings of self-recording instruments can be used in this connection. Professor Henry gives three figures showing similar curves, illustrating the weather changes accompanying the passage of cyclones and anticyclones across the country. If such typical curves could be discussed for different sections of the United States, we should have a climatology of the United States unique in character, effective in presentation, and easily understood. Such a work we ourselves have had in hand, but have been handicapped by lack of time and by the impossibility of securing the self-recording instrument sheets needed in this investigation.

The discussion of temperature, precipitation, relative humidity, fog, sunshine, and winds is, in the case of temperature, more complete than anything yet presented, and is modelled on the standard series of data set forth by Hann in his well-known "Handbuch der Klimatologie," and long since adopted as the model for all such work. New calculations have been made in several cases, and many new charts are given. We note data regarding the greatest amount of snow which has fallen in any twenty-four hours, which we believe to be new. This textual descriptive portion of the volume covers 84 pages, and includes mention of such phenomena as cold and hot waves, thunderstorms, tornadoes, chinook winds, etc., and at the end some discussion of seasonal variations of the weather. These first 84 pages make up that part of the book which will be most generally read. They present, with the numerous and well-chosen illustrations, an adequate picture of the climatology of the United States for the general reader, or for the student.

Following this text we find General Tables, including the following: monthly and annual mean temperatures for selected stations; absolute maximum and minimum temperatures for selected stations, with year of occurrence (1871–1903); monthly and annual mean maximum and mean minimum temperatures for 32 stations; absolute range of monthly mean temperatures at selected stations; monthly and annual mean precipitation for selected stations; average number of days with 0.01 inch or more of precipitation for selected stations; monthly and annual mean relative humidity for selected stations; mean monthly and annual percentages of sunshine; prevailing winds for selected stations. After these general tables, and occupying by far the larger part of the volume, come condensed summaries, grouped by the different sections and States, for the regular and voluntary observer stations of the Weather Bureau, with a brief statement as to the location of each station; the duration of the record; the exposure of the instruments, etc. A special discussion, usually very brief, but in some cases quite extended, of the physical features and of the climate of each State, precedes the tables, which include monthly seasonal and annual means, and dates of temperature extremes, usually for the period Jan. 1, 1894, to Dec. 31, 1903.

Our notice of the "Climatology of the United States" has been extended to a rather unusual length, but we feel that the volume is of such importance that it deserves such distinction. Several suggestions as to changes, additions, or improvements will doubtless occur to any one who examines the *Bulletin* critically. As for ourselves, we prefer to welcome this most useful compilation as a great advance on anything which we have had hitherto, and abstain from such suggestion except in one case. We do not find specific mention in all cases of the methods of reduction employed in constructing the climatological charts, nor of the fact whether the observa-

tions were reduced to the same period of time. These matters seem to us of fundamental importance, and one of the most thoroughly-justified and most frequently-made criticisms of our climatological work in this country concerns this very matter of publishing data and charts in which the observations were not reduced to the same periods of time. But, on the other hand, we now have something, where previously we had hardly anything. The work, as we happen to know, was carried on by Professor Henry under many disadvantages, and in the midst of other duties. As it stands, it represents a body of material of immense value, now rendered accessible to any one who wishes to secure it. This *Bulletin* will certainly help greatly in the advance of a more rational and systematic study of the climatology of the United States. It will receive a hearty welcome at the hands of climatologists the world over. R. DEC. W.

Climatological Atlas of India. Published by the Authority of the Government of India under the Direction of Sir John Eliot, K.C.I.E., F.R.S., late Meteorological Reporter to the Government of India and Director-General of Indian Observatories. Issued by the Indian Meteorological Department, 1906, fol. Pp. XXXII. Pls. 120. (Price in the United Kingdom, 36 shillings.)

It is surely seldom that a reviewer has so wholly satisfactory a task as that which falls to our lot in calling attention to the new *Climatological Atlas of India*—a work of art of the highest order of cartographic excellence, and a climatological publication which must certainly rank among the very foremost of all the volumes which have been devoted to climatology or to meteorology. This *Atlas* at once recalls the magnificent *Atlas of Meteorology* (Vol. III of Bartholomew's *New Physical Atlas*) of 1899; for these two volumes are much alike in size and in the general excellence of their make-up, the well-known house of Bartholomew, in Edinburgh, having produced the charts in both of them. It also brings to mind the fine climatological atlas of the Russian Empire, of the year 1900, published by Rykatcheff, Director-General of the Central Physical Observatory at St. Petersburg, as a memorial volume in commemoration of the fiftieth anniversary of the foundation of that institution.

The *Climatological Atlas of India* was prepared by Sir John Eliot, lately Meteorological Reporter to the Government of India, a man widely known for his activities in that trying position, and for numerous publications on the meteorology of India. The data used in the preparation of the charts are chiefly those recorded during the first twenty-five years (1876–1900) of the operations of the Indian Meteorological Department. We learn from the Preface, to our great satisfaction, that a Handbook of the meteorology of India is now in course of preparation, in which a full statement of all the more important features of the climates and weather of India will be given and which will supplement the Atlas. Together these two volumes will give a presentation of the meteorological conditions of India without a parallel in any part of the world. Meteorological work and investigation in India have for years been known the world over. From the time of Piddington's famous "First Memoir on the Law of Storms," published in 1839, the names of many Indian meteorologists who have made a mark in the progress of the science have become familiar—*e. g.*, Wilson, Chambers, Dallas, Hill, Blanford, and Eliot. Last, but certainly not destined to be least, comes Dr. Gilbert T Walker, the present Meteorological Reporter to the Government of India, who, although but recently called to that important office, has already shown that he is the right man in the right place, and that he will be a worthy successor to Blanford and Sir John Eliot. Fascinating India certainly is in its unique variety of climates ; in its stupendous problems of famine and flood ; in the possibility

of vast benefit to millions of men in the accurate forecasts of its monsoon rains. To be able to study Indian climatology with such a body of charts as are here collected is a pleasure which it is hoped many will enjoy.

The *Introduction* gives a short history of meteorological observation and organization in India, including a list of publications of the Meteorological Department and a list of the observatories, and then follows a brief, compact, and thoroughly satisfactory discussion of the charts. Plate I is a splendid general orographical map of India, the colouring of which is admirably adapted for bringing out the geographic details which are important in an understanding of the meteorology. Several cross-sections help to make clear the principal features of the topography. Other plates show the political, rainfall, medical, and meteorological divisions. Two large charts showing, for Southern Asia and the Indian Ocean, the isobars and winds for January and July are followed by smaller charts of pressure and wind for 8 A. M., 10 A. M., and 4 P. M. for each month and for the year; also by monthly and annual charts of mean pressure and wind for the day, of actual diurnal range, and of diurnal range reduced to sea-level. The temperature charts include the following: mean daily temperature, mean maximum, and mean minimum for each month and the year; diurnal range, absolute maximum, and absolute minimum for each month and for the year. Relative and absolute humidity and cloudiness are shown for each month and for the year (mean daily, 8 A. M. and 4 P. M. means). The rainfall charts include monthly and annual charts of normal precipitation and of the number of rainy days; seasonal rainfall, number of rainy days, and noon pressure at 10,000 feet for January-February; March to May; June to October; November-December; December-April, and May November. Storm tracks are shown with particular detail on monthly charts.

These 120 plates are coloured with that good taste and effectiveness which characterized the charts in the *Atlas of Meteorology*. For our own part, we have no single adverse criticism to make. A good many of the maps present details which are not commonly charted or expected; but the need of their inclusion in this *Atlas* is established by the name of the compiler, and they certainly contribute greatly towards making the *Climatological Atlas of India* a volume of extraordinary excellence and value. This *Atlas* takes a very prominent place in the splendid series of *Memoirs* and other publications of the Indian Meteorological Department. R. DEC. W.

Structural and Field Geology: For Students of Pure and Applied Science. By James Geikie, LL.D., etc., Professor of Geology and Mineralogy in the University of Edinburgh. New York: D. Van Nostrand Company, 1905, pp. 435.

This exceedingly attractive volume, which deals almost wholly with the side of practical geology, will be welcomed by all—teachers, students, field-surveyors, engineers—who are in any way associated with the study of geology or the interpretation of facts in the field. Judiciously laying aside considerations which are involved in the theories and outer conceptions of geology, the author, whose training and power of lucid exposition have made him particularly fitted for the service which he now gives over to others, enters directly upon the consideration of the structural aspects of rock-formations and their appearance in the field, and follows with explanations regarding their manner and method of occurrence, their deformations and alterations, the laws and conditions which govern these changes, special formations, etc., always maintaining well to the front the practical aspects of every form of inquiry. Concluding chapters are on geological survey, geological aspects and sections, and the economic aspects of geological structure. The book is of a kind that

few students in geology can well afford to do without, and it appeals to the specialist through its numerous facts and the force of opinion which their interpretation carries. Differences of opinion which one may hold with the author on certain obscure problems have no place in the review of a book which is replete with information, and which seeks to present chiefly the accepted or recognizable facts in the field. The unusually good quality of the illustrations which illumine the text, vastly superior to what one generally finds in manuals of geology, helps not a little to the attractiveness of this particular volume. A. H.

Handbuch der Geographischen Ortsbestimmung für Geographischen und Forschungsreisende. Von Dr. Adolf Marcuse. x and 342 pp., 54 Illustrations and 2 Star Maps. Friedr. Vieweg & Sohn, Braunschweig, 1905. (Price, M. 10.)

This book is especially adapted for the needs of teachers and students of mathematical geography and for explorers. It deals with the most important and practical methods of determining time, latitude, longitude, and azimuth. Though the extension of geographical surveys is continually adding to the number of points whose position has been fixed by triangulation, there are still large parts of the world where these fixed points are not available for starting a survey, and it is therefore necessary for the surveyor himself to establish the positions between which he measures his baseline. Before going into the field, therefore, it is highly desirable that the explorer or traveller should master the best methods devised for this purpose. Dr. Marcuse's book supplies the student who has the preliminary mathematical training required with the textual assistance he needs.

After treating of the astronomical-geographical bases of surveying, Dr. Marcuse describes and summarizes the most important nautical almanacs and ephemerides in use, and the tables of logarithms, etc., which lessen the labour of computing the observations. This is followed by a very complete and well-illustrated account of the principal instruments used. The second half of the book is given to descriptions in detail of the methods used in determining geographical positions.

Nouvelles données sur la Zone Littorale d'Angola. Par Paul Choffat. (Contributions à la Connaissance Géologique des Colonies Portugaises d'Afrique, No. 2), 4to, 78 pp., 4 Plates, illustrating fossils, and 3 Figures in the Text. Comm. Geol. Portug., Lisbon, 1905.

One difficulty in depicting the geology of Angola has been the inadequacy of the maps, which, as yet, are on too small a scale to show the results of detailed geological study, and, in other respects also, are misleading. For example, the largest scale map (1:1,000,000) shows the railroad line in operation from Loanda, not where it was actually built, but along the route as at first projected. The results of geological investigation along the coast show that this zone of Angola, from Ambriz to the south of Mossamedes, consists of sandstones, probably Palæozoic, strata of the Cretaceous, Tertiary strata, probably Miocene, and superficial deposits. Little is yet known of the tectonic conditions that helped to produce the surface forms. A large part of the text is palæontological.

Handbuch der Erdbebenkunde. Von August Sieberg. xviii and 362 pp., 113 Illustrations, Maps and Index. Vieweg & Sohn, Braunschweig, 1904. (Price, M. 7.50.)

The author treats the phenomena of earthquakes, the methods of studying them, the instruments used in their investigation, and the mathematical and theoretical sides

of the subject. Many pictures, diagrams, maps, and tables are included in the text. While the book is scientific, it is well arranged, simply written, and is intended primarily as a handbook for the laity. The large amount of data, methodically presented, makes it also a convenient manual for scientific men. The work is almost encyclopædic. It even includes a few pages on the question of earthquake prediction—a topic that is historically interesting, though the author emphasizes the statement that, in the present condition of seismology, there is no such thing as accurate prediction of earthquakes.

The many phases of the subject which are treated at length include a discussion of the kinds of earth movements; the geographical distribution of earthquakes, including a concise, classified statement of the most important shocks within the historical period (our great earthquake of Aug. 31, 1886, is assigned to Charleston, *N.* C.); the classification of earthquakes, according to origin; nature of the shocks as to energy, duration, periodicity, etc.; influence of earthquakes upon the earth's crust, water, and buildings; phenomena accompanying earthquakes; seaquakes (25 pp.); instruments used for recording and measuring earthquakes; methods of investigation (30 pp.), including the determination of the epicentral tract, of the force exerted at the epicentrum and other illustrations of the mathematical treatment of problems; and the historical development of earthquake investigations, including the present observation service in all countries, the distribution of seismic observatories, the number and kind of seismographs used at each station, etc. This scholarly compendium should be in the hands of all who are interested in the subject.

Camp-Fires in the Canadian Rockies. By William T. Hornaday, Director of the New York Zoological Park. xvii and 343 pp., 70 Illustrations by John M. Phillips, 2 Maps, and Index. Charles Scribner's Sons, New York, 1906. (Price, $3.)

This is one of the best "Outing" books that have appeared in our country for years. Mr. Hornaday spent some time in the fall of 1905 among the superb mountains of southeast British Columbia between the Elk and Bull Rivers, which seem to be the special paradise of the mountain goat and certain other wild creatures. This region, a little north of the Kootenay mining district, has not been over-described, and the grand aspects of nature, together with the interesting animals found there, are well worthy of a book. Mr. Hornaday's special purpose was to study the mountain goat, one of the most remarkable of animals; and it was to his great advantage that his companion was Mr. Phillips, the State Game Commissioner of Pennsylvania, an expert with the camera, who has produced many pictures for this book that have rarely been equalled. The whole expedition was a grand success. Hundreds of mountain goats were seen, and some of them were photographed with the animals only four to twelve feet from the instrument. A number of these views are really startling, for Mr. Phillips often clambered out on the almost precipitous face of the rocks in his enthusiasm to secure good negatives. They were secured at risks to life and limb, and the reader will probably agree with Mr. Hornaday that Mr. Phillips was too venturesome.

Mr. Hornaday says that the mountain goat in some respects is the bravest and hardiest of our hoofed animals, and the only one that is practically devoid of fear. Very few have recognized it as an unrivalled mountaineer:

> It is my belief that no animal, hoofed or clawed, can surpass the climbing feats of the mountain goat. Certainly there is no American quadruped, not even the bold and hardy mountain sheep, which will, with the utmost indifference, climb an eighty-degree precipice, or jog across the face of a five-hundred-foot wall on a footing so narrow and uncertain that the strongest glass cannot detect it.

About half the book is given to the life and ways of this animal. Mr. Hornaday's map shows that its habitat extends as far south as northwest Wyoming and as far north as the mountains in the Mount Wrangell region of Alaska. Few mountain goats have thrived in captivity; but Mr. Hornaday brought five young ones east with him, and when he was writing his book they were in the best of health.

The book also contains most readable chapters on grizzly bears, which are becoming so scarce in our country that sportsmen have to go to Canada to hunt them; on the mountain sheep and other game, the wonderful trout fishing, and other features of the trip which made it delightful and a source of recuperation to all concerned. The author is in closest and most intelligent sympathy with the life of the great wilds, and this makes what he says both authoritative and pleasant to read. He writes of all these animals as their friend and not their foe. He killed some of them, but only for important purposes; and he expresses the wish that the Canadian laws for the protection of big game may be more stringently enforced and that the number of animals which one man is permitted to kill in a year may be reduced. The publishers have produced the book very handsomely.

Die Gründung von Deutch-Ostafrika. Kolonial-politische Erinnerungen und Betrachtungen. Von Dr. Carl Peters. v and 276 pp., 14 Portraits and Index. C. A. Schwetschke & Son, Berlin, 1906. (Price, M. 4.)

Dr. Peters had a most prominent part in opening a vast territory in East Africa to German governmental control and to the colonial enterprises of his countrymen. Results of value are constantly accruing, and the aspirations of Peters, Jühlke, and other pioneers for the development of this region as a German possession are being fully realized. The book tells the story of pioneer effort in this virgin field; and it will be welcomed, not only for the history it records, but also because it is from the pen of a man who was foremost in making that history. Peters gives full credit to the good work of the men who participated in his labours, though he unsparingly criticizes one or two who did not meet with his approval. The book will be a valued source of information on the beginnings of German colonial enterprise in East Africa.

The excuses which Dr. Peters makes for the bloodshed by his Emin Pasha Relief Expedition on his march to Victoria Nyanza fail to wipe out the stain. This subject was threshed out long ago, and the only comfortable thing to say in relation to it is that that record of slaughter by a white expedition is probably unexampled in other annals of African exploration.

Die Reformation der Kartographie um 1700. Von Christian Sandler. With Atlas of Facsimile Maps. R. Oldenbourg, Munich and Berlin, 1905. (Price, M. 20.)

The Academy of Sciences in Paris was the leading agency in the reformation of cartography. The work was begun systematically in the last twenty-five years of the seventeenth century. Delisle's maps of the world and the continents, which were produced on the borderland between the seventeenth and eighteenth centuries, mark the climax of this great work of cartographic improvement; and with the production of the last of these maps, about 1720, the participation of the Academy in the reform may be said, in a sense, to have terminated. Dr. Sandler, in a thorough and scholarly manner, has traced the progress of this reform through its various steps, assigning to each man his proper place in it. He has thus given a clear and consecutive history of a movement which resulted in the great improvement of cartography.

The two most conspicuous errors of the early cartographers were that they represented the Indian Ocean as a closed sea (a blunder that was corrected by the discovery of the sea route to India) and their great exaggeration of the extension, east and west, of the land-masses. Sailors had long insisted that the land, especially in the Mediterranean regions, was shown on the maps as reaching too far east and west, but most of the cartographers still held to their old methods of computing longitudes. There was much confusion and blundering in this respect.

Dr. Sandler shows how the progress in astronomical science gradually supplied better bases for fixing longitudes, and that even before Cassini showed the way to the determination of longitude by means of observations of the satellites of Jupiter such men as Kepler, Varenius, and others had computed many geographical positions with a nearer approximation to accuracy than had previously been made. Cassini's tables (1668) gave additional facilities, and the French took up the work of the more exact determination of longitude. The culmination of their work was reached in the achievements of Delisle, who devised some new cartographic methods which contributed to notable results; and one of the most valuable parts of Dr. Sandler's work is his discussion of Delisle's methods.

The accompanying map-portfolio contains facsimile reproductions of Delisle's maps and some notable maps of an earlier date. Traced on transparent paper overlying each map are the outlines of the continents and some of the larger islands as they are known to-day. It is thus easy to see how far and in what detail these early maps differ from those of to-day in the position and shape they give to the large land-masses. It is a demonstration of the fact that Delisle's maps approximate the truth much more closely than others made very near his time and, indeed, in the early days of this reform movement. Dr, Sandler's able contribution to the history of this transforming period in the development of cartography will be very widely appreciated by students of the development of geographical science.

Geography of Nebraska. By George Evert Condra. viii and 192 pp., 118 illustrations from photographs, Maps and Index. The University Publishing Company, Lincoln, Nebraska, 1906.

Dr. Condra is Associate Professor of Geography and Economic Geology in the University of Nebraska. Such books as this one on Nebraska and that which Prof. Hall has written on Minnesota, are needed. There is great lack of first-rate geographical literature relating to the various States. This little book on Nebraska presents to the boys and girls, in an edifying and attractive manner, the geography of the great region in which they are chiefly interested. It is also adapted for those general readers who do not need a fuller treatment of the subject; and for all readers, so long as the geography of the State is not completely treated in any book.

The introductory chapter gives a general idea of the scope of the book. It is followed by ten chapters dealing with the geological structure—the story of the origin of the rock formations, the weather, climate, water, and drainage basins of Nebraska, its four topographic regions—viz., the loess, sand hill, and plain regions, and the bad lands. Then follow chapters on the settlement and development of the State, a summary of its resources and industries, and of the methods for reclaiming the dry, wet, or sandy lands that are unfit to produce farm crops (irrigation, drainage, forestation, dry farming, and drought-resisting crops), and descriptions of the cities and towns. The book is primarily intended for use in graded schools. One of its best features is the close connection maintained throughout between geographic conditions and human development.

Le Partage de l'Océanie. Par Henry Russier. xi and 370 pp., Illustrations and Maps. Vuibert & Nony, Paris, 1905. (Price, 7.50 fr.)

In the past twenty years events have tended more than ever before to make the Pacific a centre of international politics. Among these events have been the development of large interests pertaining to the United States and Germany. The history of colonial enterprise has recently been told by Dr. Supan; and now comes this volume by Dr. Russier. It is a rather more extended treatment of the same subject, and is an important compilation of facts dealing with the Pacific Islands, their inhabitants, and their relations with the white race from the earliest times to the present day. The volume is a fine specimen of book manufacture, abounds with beautiful photographic illustrations, and its maps, though merely black-and-white sketches, are fairly adequate for the essential needs of the reader.

In the first 94 pages the author gives a carefully-written account of the genesis of the archipelagoes, their natural conditions, and their indigenous populations. The following 88 pages are devoted to a concise but complete history of the voyages of discovery for three centuries, beginning with the sixteenth; of the development of missionary enterprises and the political results of these religious and educational movements; of the rivalries that grew up between the European nations which, through missionaries and teachers, had secured a foothold, and of the resulting conflicts and international competition. The remainder of the work, about 175 pages, is given to the development of the French, English, United States, and German colonies.

The author has little faith that France will long continue to exercise important influence in this part of the world; but he believes that brighter prospects await the enterprises of the United States and Germany, which, he says, have the means of communication to keep in close touch with all their Pacific interests. He thinks, however, that the appearance of Japan as a colonial Power in the Pacific cannot be viewed with complacency by other nations, and is, to say the least, a disquieting fact.

Ostasienfahrt. Erlebnisse und Beobachtungen eines Naturforschers in China, Japan, und Ceylon. Von Dr. Franz Doflein. xiii and 511 pp., Maps, Illustrations, and Index. B. G. Teubner, Leipzig, 1906. (Price, M. 13.)

The book tells the story of a naturalist's experiences and observations in Oriental waters. It is intended for intelligent readers generally, and is one of those works, increasing in number, which give a popular account of scientific labours. Dr. Doflein made the journey in 1904, with the special purpose of investigating fauna along the eastern Japanese coast, which not only offers unusual forms peculiar to that region, but also contains an admixture of marine life belonging to waters of more northern latitudes, and also to those of far southern regions. It is here that the Kuro Siwo, or the warm current flowing north along the coast of Japan, meets the cool Kurile current from the north, and the observer found that here the relations between the northern and southern fauna might well be studied. The result of his investigations, however, seems to show that there is no sharp boundary between the migrations of the southern and northern faunas, and that the change from one to the other takes place gradually, and all along the eastern coast of Japan. Dr. Doflein thinks that the reason for this is that the north and south flowing currents intermingle and change their position with the time of the year.

He found that the fauna in Sagami Bay to the south of Tokio is remarkably rich, owing, doubtless, to large supplies of food, due to mortality among the sur-

face organisms which perish on account of the change of temperature where the two currents meet. He says that many of the so-called deep-sea forms of life may more properly be regarded as still-water forms; for their great need is absence of motion in their environment rather than any other of the peculiar conditions of the deep sea. He thinks that their vertical range will be found to be considerable when the middle depth of the seas has received the same attention from oceanographers that has been given to the deep sea and the surface waters.

On his journey home, Dr. Doflein visited Ceylon, and he tells many interesting things about his studies of the fungus-growing termites and the spinning ants on that island. Other chapters deal with the customs and ways of the various peoples met on the journey, and especially in Japan. The volume belongs to the best class of scientific writing designed for the general public. It has been produced in the best style, and many of the illustrations have much merit.

Aus Busch und Steppe. Afrikanische Expeditionsgeschichten. Von Adolf v. Tiedemann. 251 pp., and 57 illustrations, Winckelmann & Söhne, Berlin, 1905. (Price, M. 3.)

The author was one of the companions of Dr. Carl Peters on the German Emin Pasha Relief Expedition in 1889–90. Dr. Peters encountered enormous difficulties on this journey, from the mouth of the Tana River to the Victoria Nyanza. He had repeated fights with the Massai and other peoples, and was severely criticized, on his return, for his treatment of them. The results of the journey have been fully published, and Mr. Tiedemann's own impressions of it have appeared in print. The present book, however, is also well worth reading. It consists of a number of sketches of life and incident during that gruesome march. These sketches are of a nature to relieve the monotonously unpleasant records of the unfortunate expedition. The author has literary talent and the gift of humour, which he infuses into his account of some incidents of that long tramp that may be treated in light vein. There are other stories, such as "Christmas in Massai Land," that have strong dramatic interest, and are well told. The sketches are evidently honest narrations of things that actually happened, and they throw a sidelight on characteristic and also unusual incidents of caravan travel that are enjoyable, and often valuable bits of information. The illustrations are admirable.

Au Pays des Pyrénées. By Emile Daullia. 8vo. Charles Mendel, Paris, s. a.

It is not easy to classify this new book by the author of the "Tour du Mont-Blanc." There is a good deal of light geography in it, considerable about the author himself, especially in the first half; long and not strictly amusing or enlightening conversations with hotel people, apothecaries, alpine amateurs, and guides, and much nomenclature scattered through very attractive descriptions of landscape. It may be said that one-half of the book is devoted to cities and their monuments cursorily alluded to, the other half to the country and its mountains. The French Pyrenees are treated in a sort of panoramic way; now and then a peep at the Spanish part of the chain is interpolated. In short, it is pleasant and light reading, and the photographs are handsome.

Mr. Daullia does not pretend to specialism in mountains and mountaineering. What we detect in his plan of writing is, a rather careful survey of the *surroundings* of the particular range that interests him. Those surroundings are seldom

treated in the manner in which he attempts it; they are mostly disposed of in a rapid way, as mere preliminaries to the main subject, or in the dry guide-book or geographical handbook style. The author introduces them to us with a great deal of detail, enlivening it by personal items not always indispensable, but sometimes very characteristic and useful. After reading him we feel that we know something concerning the base and approaches to the core, and feel even tempted to believe that, thus prepared, we might attack that core itself. It is a new departure in alpine literature, already announced in his previous work, but carried further and brought out more clearly in this one. We may regret, perhaps, that he does not enter into greater detail about the numberless points of historic interest, offered by the cities of southern France, which he traverses. But antiquities are not his field, and monuments appeal to him only as salients upon the relief-chart of nature.

In judging of the Pyrenees, Mr. Daullia naturally drifts into a comparison of their scenery with the Alps. He places the former on a level much lower than that of the latter. We may well conceive that a mountain chain, less elevated and massive, will not come up to the standard of one that forms the pinnacle of a continent. Still, others have allowed to the Pyrenees a style of natural beauty and grandeur that might hold its own alongside of the Alps. chiefly on account of its differentiation in type. Properly speaking, no two regions can be fairly compared with each other. Each has its merits that are peculiar to it, its charms in which the other is lacking. The personal element comes in for a great deal also. Not only does one landscape appeal to one person more than to another: the mood and the circumstances under which the observer is placed influence and bias the judgment. The Alps are certainly grander, on the whole, than their more modest neighbours, but the book of Mr. Daullia itself convinces us that the latter are, in many ways, worthy corollaries of the former, and deserve the attention of the lover of nature, the seeker of alpine sport, the investigator, and the student of man's past and present. AD. F. B.

The Land of Pardons. By Anatole Le Braz. Translated by Frances McGostling. Illustrated. 8vo, Macmillan Co., New York, 1906.

Beautiful and well-chosen illustrations, photographs, and charming water-colours by Gotch adorn this pretty little volume. The translation has been a labour of love; the translator was prompted to it by her fancy for the land, admiration for the author's talent, and interest in the subject. And the unpretentious volume, indeed, deserves to be translated.

That the "Pardons" of Brittany are religious celebrations is well known. An authority says about them: "They have remained unchanged for over two hundred years, and nowhere else will you find anything so deliciously obsolete. They have no resemblance to other festivals. They are not pretexts for feasting, like the "Flemish Kermesses," neither are they revels like the Paris fairs. No! their attraction comes from a higher source. They are the last vestiges of the ancient Feasts of the Dead, and there is little laughter at them, though much prayer." The greater portion of the day is spent in devotional exercises, there is mostly a procession, and towards evening some modest festivities set in, ending in a dance. The peculiar character of the Bretons shows itself on these occasions; rather demure, sober, and quiet, even in rejoicing and love. That these survivals from olden times will pass away there is no doubt—the author confesses that they have already changed much in the last twenty years—hence it is fortunate that

he observed them long ago, when they were still altered, and has recorded what he saw with the impartiality and in the kindly spirit that, towards religious performances, is so out of fashion among many.

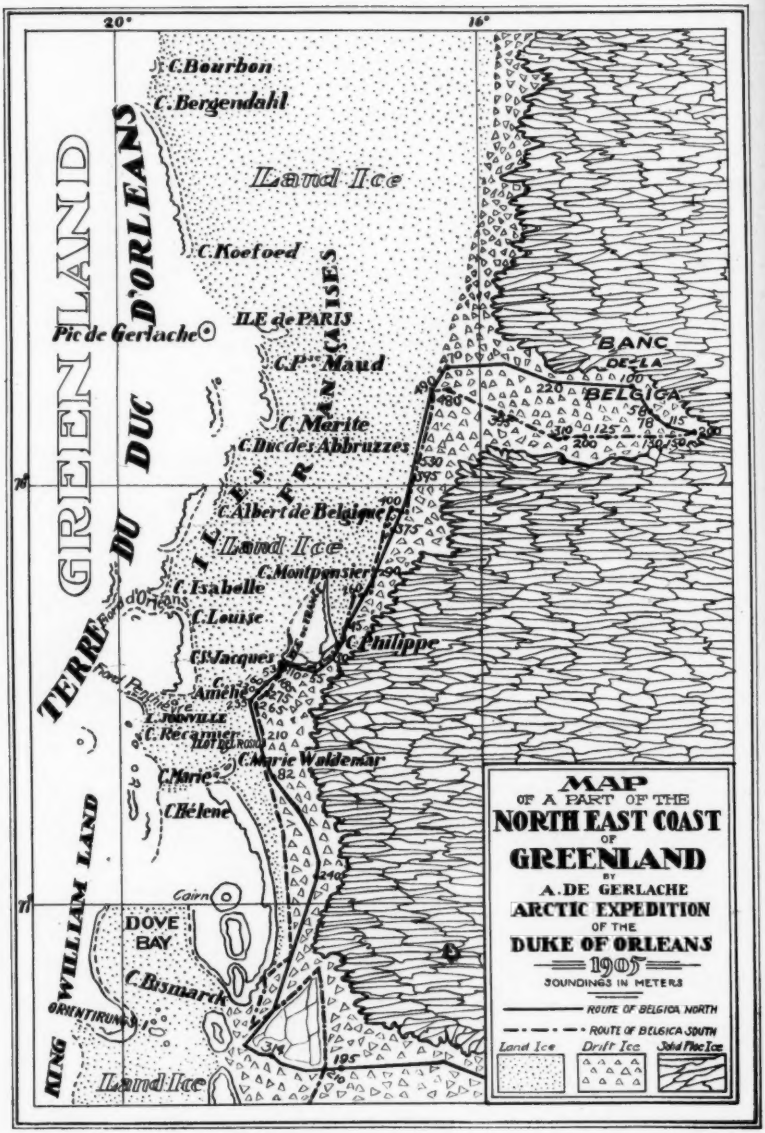
He has taken occasion of the "Pardons" to record a number of old legends of saints and of miracles, from early and later medieval days. In the faithful preservation of these lies the chief value of the book. Hardly any of them is known outside of Brittany, and many harbour traces of historic traditions. They are told with charming simplicity, in a manner and style perfectly harmonizing with the subject, and the personages introduced as authorities for them, the tellers of the tales, find their place in the frame of the story as naturally as the beautiful illustrations in the text. While the book does not, and cannot, claim to rank among scientific literature, it still has considerable ethnologic merit, and no student of Brittany, of its past and present, can overlook it. The translation seems to be, if not unimpeachable, yet commendable. It is no easy matter to render such works in a foreign language without occasional failings.

To compliment the author on his work would be superfluous. His name and fame are established; but we can thank the translator for the service she has rendered, by placing it within reach of an English public. AD. F. B.

Travels through the Alps. By the late James D. Forbes, F.R.S., Sec. R.S. Ed., F.G.S. New Edition, Revised and Annotated by W. A. Coolidge. Portrait, New Maps, Illustrations and Diagrams. 8vo. London: Adam and Charles Black, 1900.

The book of Forbes is so widely known and has been reviewed so often that it suffices to recall its great importance without more comment than to draw attention to this enlarged new edition as by far the most valuable, since the editor, the Rev. Mr. Coolidge, is a most eminent authority himself, and has not only corrected the inevitable errors of the original—errors that cannot be charged to the author, since the information was not at his command—but has added a wealth of data entirely new. This makes of the book of Forbes the most valuable source on studies of the glaciers in the regions of which it treats, not excepting the exhaustive work of Heim, which covers more ground, but is not based upon so much practical acquaintance with the subject. Criticisms are uncalled for, and merely in order to escape a possible reproach of partiality shall we notice two slight objections. One is certainly due to an oversight of the printer or proof-reader. On page 98 a "portable telescope (*Feldstecke*) by Ploessl" is mentioned. It should be *"Feldstecher."* The footnote on p. 79 also reads somewhat curiously. Treating of the sheep pasturing about the Mer de Glace, the editor rises to the comment: "Accordingly, here and elsewhere, a traveller may be incommoded by the importunate earnestness with which the sheep surround and follow him, supposing he has brought salt with him. They are as tame as domestic animals." We have always thought sheep were classed among domestic animals in general, like horses, cattle, and others that associate with man. They are certainly looked upon as such in Savoy, Switzerland, and, as far as we know, even in England. With the exception of the mouflon, Europe has no wild species.

Some of the maps in the older editions of this book have been replaced by more recent ones, thoroughly improved, while a few have been omitted for good and valid reasons. AD. F. B.


20°
16°
76°
71°
GREENLAND
TERRE DU DUC D'ORLEANS
KING WILLIAM LAND
C. Bourbon
C. Bergendahl
Land Ice
C. Koefoed
ILE de PARIS
Pic de Gerlache
C.P.te Maud
C. Marite
C. Duc des Abbruzzes
ILES DES FRANÇAISES
C. Albert de Belgique
Land Ice
C. Montpensier
C. Isabelle
C. Louise
C. Philippe
C. St Jacques
C. Amélie
I. JOINVILLE
C. Récamier
C. Marie Waldemar
C. Marie
C. Hélène
Cairn
DOVE BAY
C. Bismark
ORIENTIRUNA
Land Ice
BANC DE LA BELGICA
MAP
OF A PART OF THE
NORTH EAST COAST
OF
GREENLAND
BY
A. DE GERLACHE
ARCTIC EXPEDITION
OF THE
DUKE OF ORLEANS
1905
SOUNDINGS IN METERS
ROUTE OF BELGICA NORTH
ROUTE OF BELGICA SOUTH
Land Ice
Drift Ice
Solid Floe Ice